Building Modifications & Enforcing the 2012 IECC

Residential Workshop 2

MISSOURI DEPARTMENT OF NATURAL RESOURCES

RECOVERY.GOV

Introductions

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Project email:

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Code officials:

Name

Municipality

Status of Residential Codes

Overview

Project funded by the Missouri Department of Natural Resources (MDNR) with American Recovery and Reinvestment Act of 2009 (ARRA) funding.

4 Locations and Webinars:

- St. Louis (December 1st – 2nd)
- Springfield (December 5th – 6th)
- Kansas City (January 24th – 25th)
- Columbia (February 27th)

Objective of the Workshop: Work with municipalities and counties across the state to identify opportunities to adopt or enhance compliance with the 2009 or 2012 International Energy Conservation Code (IECC) at a local level.

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Agenda

Topic	Approx. Time
Introduction	15 minutes
Residential Remodels and Additions for 2012 IECC	50 minutes
Tools to Enhance Compliance	50 minutes
Summary	5 minutes
Total	**2 hours**

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Some Important Points

Overall

- Discussion-based

What can you expect?

- Can follow code citations in [ ]

Before we get started…

- Cell phones

Overview

- The International Code Council® (ICC) develops codes
- The IECC looks at energy consumption and cost savings in buildings
- Three year cycle for updates
- Several codes by the ICC
  - International Building Code®
  - International Residential Code®
  - International Fire Code®
  - International Mechanical Code®
  - International Property Maintenance Code®

Overview

2012 IECC – Residential Section

1. Administration
2. Definitions
3. General Requirements
4. Residential Energy Efficiency
5. Referenced Standards

Overview

R101.3 Intent. This code shall regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Overview

Residential provisions of the IECC attempts to regulate energy use:

- [R402] Building thermal envelope
- [R403] Systems
- [R404] Lighting

IECC does NOT regulate:

- Mechanical system efficiencies
- Appliances
- Water consumption

Topic 1

Residential Remodels and Additions for 2012 IECC

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Topic 1 Objectives

- Identify how additions/alterations/repairs trigger the 2012 IECC
- Identify the compliance paths for residential modifications

What Triggers the 2012 IECC?

Remodels and additions

- What activity triggers the code?
- Definitions
- Exceptions

What Triggers the 2012 IECC?

What's an addition?

ADDITION. An extension or increase in the *conditioned space* floor area or height of a building or structure.

What's conditioned space?

CONDITIONED SPACE. An area or room within a building being heated or cooled, containing uninsulated ducts, or with a fixed opening directly into an adjacent *conditioned space*.

What Triggers the 2012 IECC?

101.4.5 Change in space conditioning. Any noncondi-tioned space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.

What Triggers the 2012 IECC?

What's an alteration?

ALTERATION. Any construction or renovation to an existing structure other than repair or addition that requires a permit. Also, a change in a mechanical system that involves an extension, addition or change to the arrangement, type or purpose of the original installation that requires a permit.

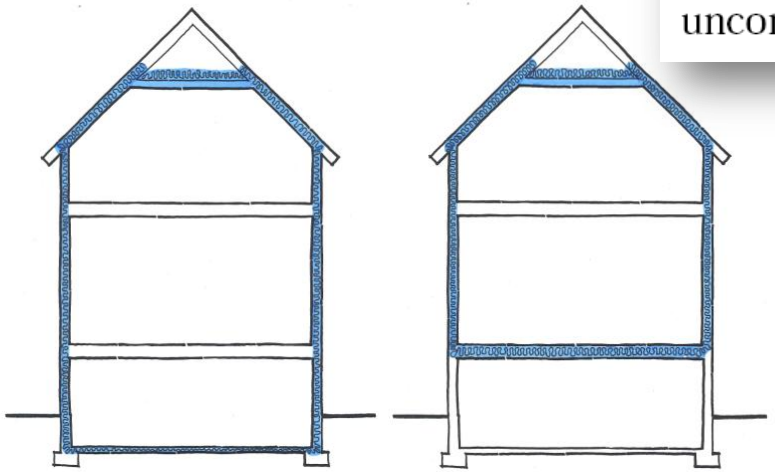
What's a repair?

REPAIR. The reconstruction or renewal of any part of an existing building.

What Triggers the 2012 IECC?

What's building thermal envelope?

BUILDING THERMAL ENVELOPE. The basement walls, exterior walls, floor, roof, and any other building element that enclose *conditioned space*. This boundary also includes the boundary between *conditioned space* and any exempt or unconditioned space.



What Triggers the 2012 IECC?

101.4.3 Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Exception: The following need not comply provided the energy use of the building is not increased:

What Triggers the 2012 IECC?

Applicability

- Code applies to residential buildings
- New construction, additions, alterations, renovations or repairs
- Additions can comply alone or in combination with existing building

Exempted Buildings

- Existing buildings
- Historic buildings
- Buildings (or portions of) that are neither heated or cooled (e.g. garage)

Exempted Alterations

- Eight exceptions for alterations

What Triggers the 2012 IECC?

8 Exceptions

1. Storm windows installed over (E) window.
2. Glass only replacements in an (E) window.
3. (E) cavities are filled with insulation.
4. (E) cavity is not exposed.
5. Reroofing for roofs where neither the sheathing nor the insulation is exposed.

(E)=Existing

Exceptions 6-8 are more relevant to commercial buildings

The IECC "is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances."

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What Triggers the 2012 IECC?

What's a sunroom?

SUNROOM. A one-story structure attached to a dwelling with a glazing area in excess of 40 percent of the gross area of the structure's exterior walls and roof.

What Triggers the 2012 IECC?

R402.2.12 Sunroom insulation.

1. The minimum ceiling insulation *R*-values shall be R-19 in Climate Zones 1 through 4 and R-24 in Climate Zones 5 through 8; and
2. The minimum wall *R*-value shall be R-13 in all climate zones. Wall(s) separating a *sunroom* with a *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

TABLE R402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE
4 except Marine	0.35	0.55	0.40	49	20 or 13+5[h]	8/13	19
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13/17	30[g]

What Triggers the 2012 IECC?

R402.3.5 Sunroom *U*-factor.

1. The maximum fenestration *U*-factor shall be 0.45; and
2. The maximum skylight *U*-factor shall be 0.70. New fenestration separating the *sunroom* with *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

TABLE R402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE
4 except Marine	0.35	0.55	0.40	49	20 or 13+5[h]	8/13	19
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13/17	30[g]

What Triggers the 2012 IECC?

Which items trigger examination of the energy code?

- Home expansion
- Yard fence
- New skylight while re-roofing
- Detached garage
- Attached garage
- Bedroom addition
- New sunroom
- Window replacement
- New concrete driveway
- Furnace replacement

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What Triggers the 2012 IECC?

Which items require a permit in your municipality?

- Home expansion
- Yard fence
- New skylight while re-roofing
- Detached garage
- Attached garage
- Bedroom addition
- New sunroom
- Window replacement
- New concrete driveway
- Furnace replacement

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What Triggers the 2012 IECC?

Which of the following must comply with the residential provisions of the IECC?

A. unconditioned garage
B. thermally isolated sunroom
C. open-air, unconditioned backyard gazebo structure
D. unconditioned attic

Which of the following is exempt from the provisions of the IECC?

A. A 100 SF bathroom addition to your neighbor's home
B. My home which I plan to only heat to 64^{o}F
C. A conditioned garage addition
D. A historic home located in a locally designated historic district

Topic 1 Objectives

- Identify how additions/alterations/repairs trigger the 2012 IECC
- Identify the compliance paths for residential additions

Compliance Paths for Additions

R101.4.3 Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

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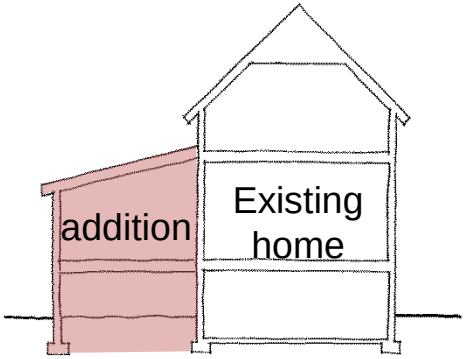
Compliance Paths for Additions



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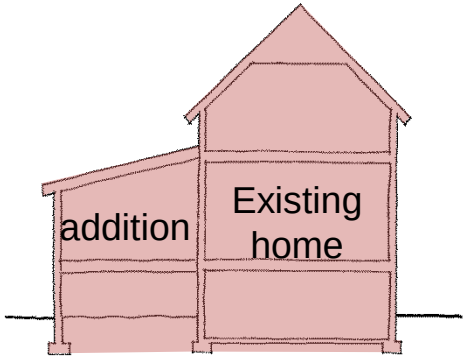

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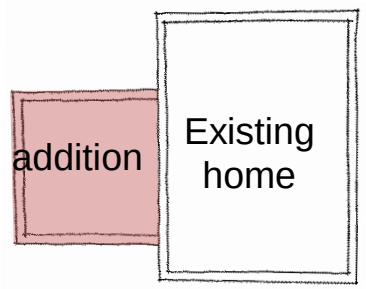

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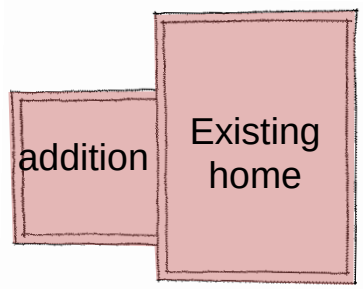

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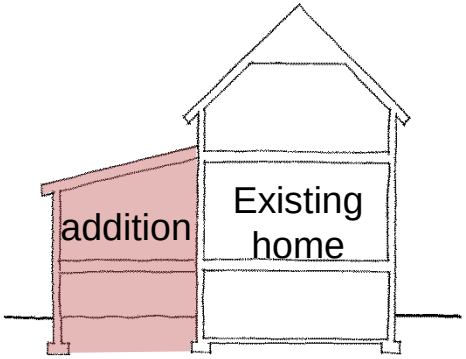
Compliance Paths for Additions



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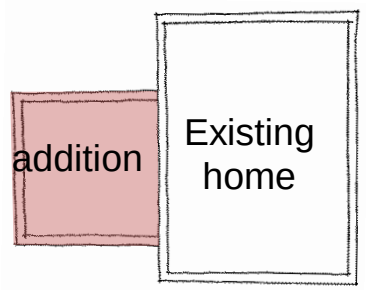

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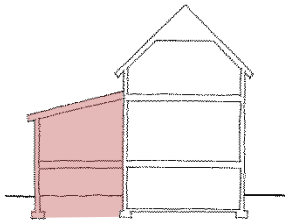
Compliance Paths for Additions

A. Prescriptive

B.1 U-Factor

B.2 UA Alternative

Prescriptive Approaches



C. Simulated Performance Alternative

REScheck Simulated Performance requires structure with four walls with unique orientation, and at least one roof and one floor.

Compliance Path – Prescriptive

TABLE R402.1.3
EQUIVALENT U-FACTORS[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR[b]	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
1	0.50	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.082	0.165	0.064	0.360	0.477
3	0.35	0.55	0.030	0.057	0.098	0.047	0.091[c]	0.136
4 except Marine	0.35	0.55	0.026	0.057	0.098	0.047	0.059	0.065
5 and Marine 4	0.32	0.55	0.026	0.057	0.082	0.033	0.050	0.055
6	0.32	0.55	0.026	0.048	0.060	0.033	0.050	0.055
7 and 8	0.32	0.55	0.026	0.048	0.057	0.028	0.050	0.055

1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13+5[h]	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

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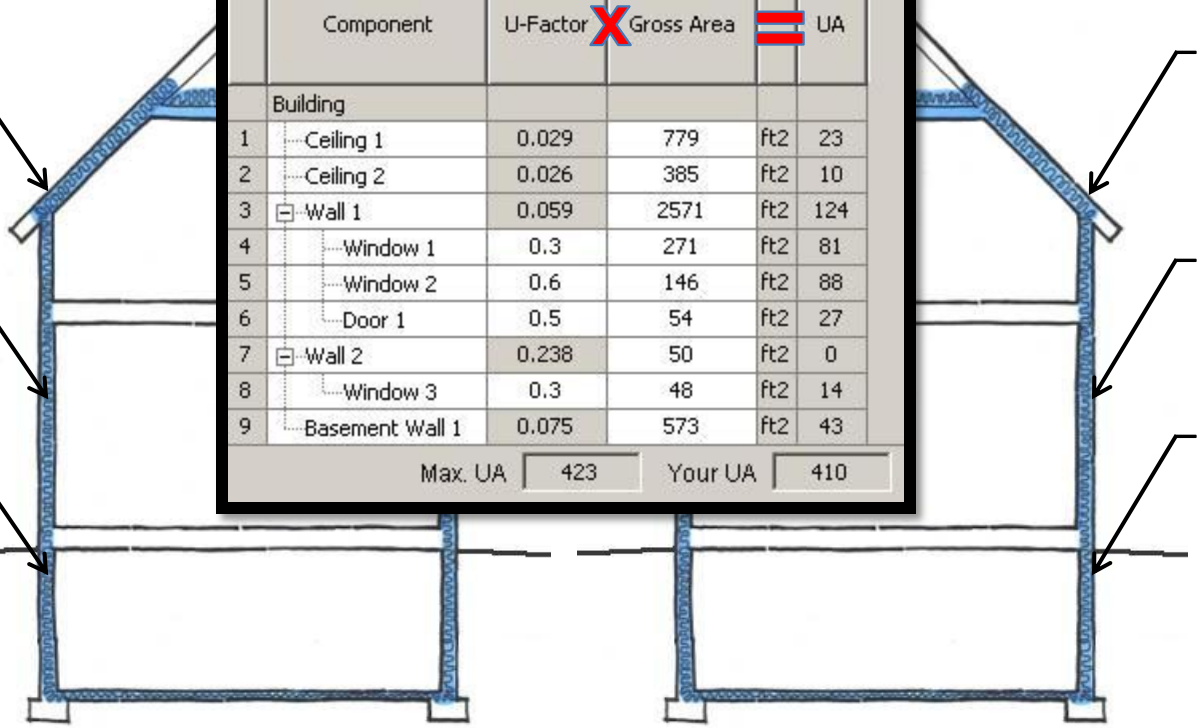
Compliance Path – UA Alternative

Vaulted Ceiling
U-Factor – 0.026
Eq. to R-49 cav

ABG Walls
U-Factor – 0.057
Eq. to R-20 cav

Basement Walls
U-Factor – 0.059
Eq. to R-13 cav

	Component	U-Factor	X	Gross Area	=	UA
	Building					
1	Ceiling 1	0.029		779	ft2	23
2	Ceiling 2	0.026		385	ft2	10
3	Wall 1	0.059		2571	ft2	124
4	Window 1	0.3		271	ft2	81
5	Window 2	0.6		146	ft2	88
6	Door 1	0.5		54	ft2	27
7	Wall 2	0.238		50	ft2	0
8	Window 3	0.3		48	ft2	14
9	Basement Wall 1	0.075		573	ft2	43
	Max. UA	423	Your UA	410		



Vaulted Ceiling
2x12 w/ R-49 cav

AGW Walls
2x6 w/ R-21 cav

Basement Walls
2x4 w/ R-13 cav

Max UA

Design UA

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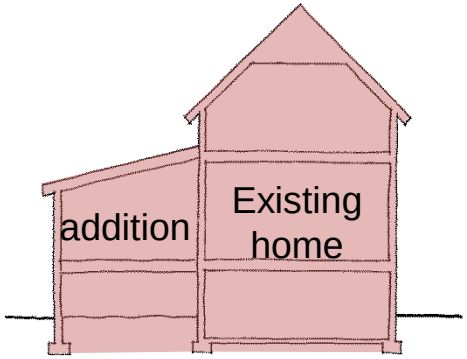
Compliance Paths for Additions



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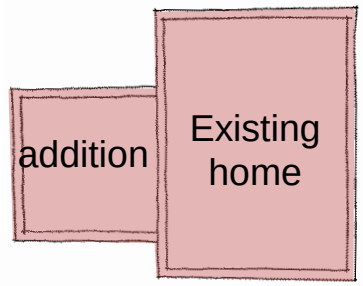

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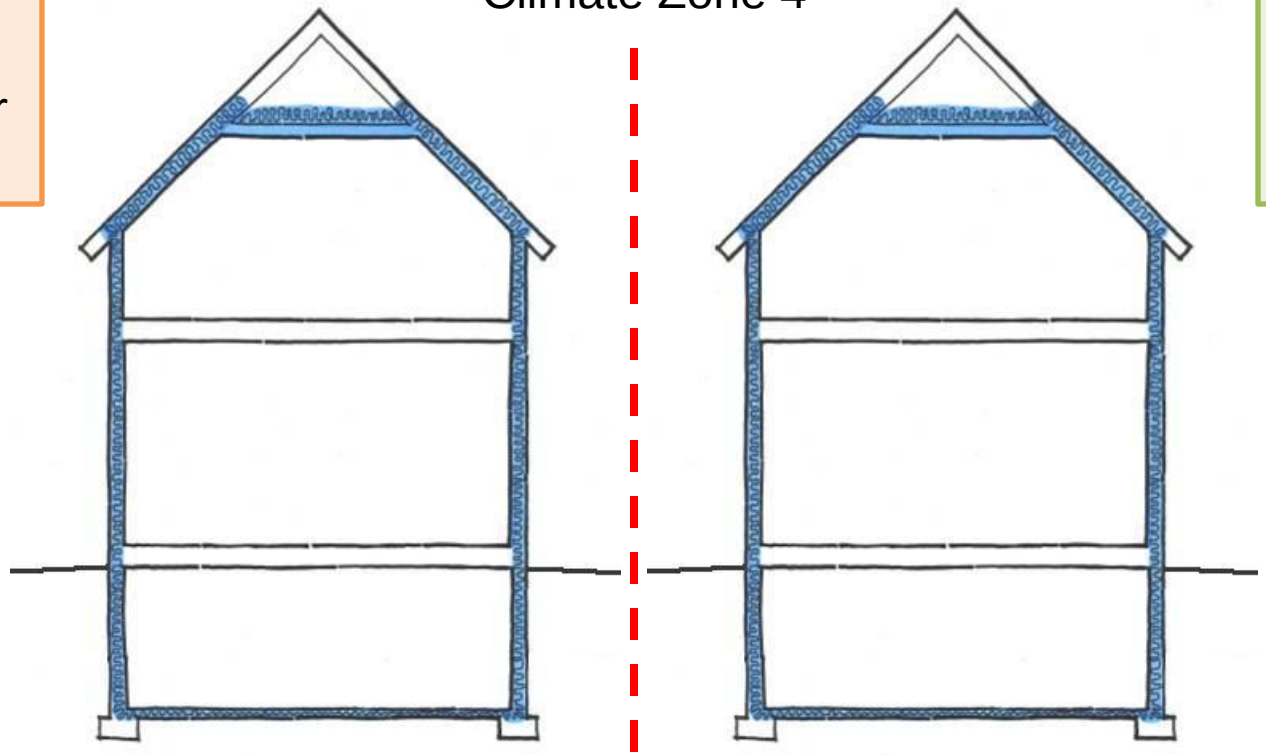
Compliance Path – Simulated Performance [R405]

Heat
+ Cool
+ Hot Water
= $917

Climate Zone 4



Heat
+ Cool
+ Hot Water
= $770

Reference Design
2012 IECC

Proposed Design

2012 IECC Resource

Interpretation questions

- Website: http://www.iccsafe.org/cs/Pages/opinions.aspx
- Phone: 1-888-ICC-SAFE (422-7233) - ext. 338077

US Department of Energy

- Website: http://www.energycodes.gov/help/

Topic 2

Tools to Enhance Compliance throughout Permit Review Process and Inspection

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Topic 2 Objectives

- Tools prior to submittal
- Review the plans review process
- Review the inspections required

Tools Prior to Submittal

Meet with concerned parties

- Discuss compliance paths, and review code requirements
- Point applicants to information
- Review common misconceptions

In lieu of meetings websites, presentations, or other sources can be used

Tools Prior to Submittal

Use of a "Determination Worksheet"

- Chicago Energy Conservation Code Compliance Determination Worksheet
  - Determine compliance requirements
  - General requirements for all projects

Use the check boxes below to determine the classification for the project.

YES	NO	
☐	☐	Is the building **5 stories or more** above grade? ▪ If you checked "YES", please complete the **Commercial Compliance Form.**
☐	☐	Is the building **4 stories or less** above grade and contains any permanent residential occupancy, such as houses, apartments, condos, or dorms (hotel and temporary housing units are not included here)? ▪ If you checked "YES", please complete the **Residential Compliance Form.**
☐	☐	Is the building **4 stories or less** above grade and does it contain any permanent residential occupancy and any other occupancy which occupies more than 15% of the total building area? ▪ If you checked "YES", please complete the **Commercial Compliance Form** as well as the **Residential Compliance Form.**

Tools Prior to Submittal

- Use of a checklist for required documents needed for permit submittal

APPLICANT'S INITIALS	VILLAGE VERIFICATION	
		1. Two set of drawings
		2. Site plan detail sheet
		3. Foundation detail sheet
		4. Floor plans
		5. Wall construction detail sheet
		6. Floor construction detail sheet
		7. Roof/ceiling construction detail sheet
		8. Chimney/fireplace & chase detail sheet
		9. Mechanical detail sheet
		10. Plumbing detail sheet
		11. Electrical detail sheet
		12. Drainage Certificate Agreement
		13. Site Development Permit/Erosion Control
		14. Contractor Listing
		15. Open Space Disclaimer or Open Space Checklist & Receipts
		16. Energy Code Compliance

Signature of Applicant _____ Date _____

Accepted: Village of New Lenox _____ Date _____

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Tools Prior to Submittal

- Might want a detailed description of what is required for the “Energy Code Compliance”

1. Two set of drawings
2. Site plan detail sheet
3. Foundation detail sheet
4. Floor plans
5. Wall construction detail sheet
6. Floor construction detail sheet
7. Roof/ceiling construction detail sheet
8. Chimney/fireplace & chase detail sheet
9. Mechanical detail sheet
10. Plumbing detail sheet
11. Electrical detail sheet
12. Drainage Certificate Agreement
13. Site Development Permit/Erosion Control
14. Contractor Listing
15. Open Space Disclaimer or
    Open Space Checklist & Receipts
16. Energy Code Compliance

Tools Prior to Submittal

Compliance forms

- Chicago, IL - Residential Compliance Form
- Fort Collins, CO - Residential Energy Code Compliance Form
- Jefferson County, CO - Residential Energy Code Submittal Requirements

Tools Prior to Submittal – Chicago, IL

☐ **A. Res*check***

RECOMMENDED METHOD Download RES*check* free at www.energycodes.gov/rescheck

RES*check* — Report, Check List, Certificate, Project Details, Permit Date — 403: Systems **Article 4* (403 is in addition to Rescheck)

Print and attach RES*check* compliance certificate. **(required)**

----------OR----------

☐ **B. Prescriptive Method**

Article 4 — 401: General — 402.4: Air Leakage
402.5: Moisture Control
402.6: Fenestration U-factor/SHGC
403: Systems
402.1: Building Thermal Envelope
402.2: Insulation Requirements
402.3: Fenestration

----------OR----------

☐ **C. Performance Method**

Article 4 — 401: General — 402.4: Air Leakage
402.5: Moisture Control
402.6: Fenestration U-factor/SHGC
403: Systems
404: Simulated Performance Alternative

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Tools Prior to Submittal – Chicago, IL

☐ **A. Res*check***

RECOMMENDED METHOD Download RES*check* free at www.energycodes.gov/rescheck

RES*check* — Report, Check List, Certificate, Project Details, Permit Date — 403: Systems **Article 4* (403 is in addition to Rescheck)

Print and attach RES*check* compliance certificate. (**required**)

Tools Prior to Submittal – Chicago, IL

☐ **B. Prescriptive Method**

Article 4 — 401: General — 402.4: Air Leakage
402.5: Moisture Control
402.6: Fenestration U-factor/SHGC
403: Systems
402.1: Building Thermal Envelope
402.2: Insulation Requirements
402.3: Fenestration

OR

☐ **C. Performance Method**

Article 4 — 401: General — 402.4: Air Leakage
402.5: Moisture Control
402.6: Fenestration U-factor/SHGC
403: Systems
404: Simulated Performance Alternative

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Tools Prior to Submittal – Fort Collins, CO

updated 11-16-201(

City of Fort Collins

Planning, Development & Transportation Services
Community Development & Neighborhood Services

2010 FORT COLLINS RESIDENTIAL ENERGY CODE COMPLIANCE FORM

Permit Number:
Address:

DIRECTIONS: Place a check next to Prescriptive, UA, or SPA indicating the path chosen. Next, circle the method within that path you intend to follow. If choosing prescriptive or UA, the applicant must also choose between an Air sealing checklist or Blower Door Test.

☐ **(A)PRESCRIPTIVE compliance for house, 2009 IRC, section N1102.1, climate zone 5.**

BUILDING ENVELOPE	INSULATION R-VALUE
Wood frame wall insul r-value	R-20 or 13+5ci
Metal frame wall insul r-value	R-13+9ci or R-19+8
Crawl space wall	R-13 or R-10ci
Roof insulation in attic	R-38
Roof rafter insulation	R-30
Walls below grade	R-13 / R-10ci
Wood floor over un-cond	R-30
Slab on grade floor, unheat	R-10, 24" DEEP
Windows	U-.35

Circle one: Air Sealing Checklist Blower Door Test

☐ **(B)TOTAL UA ALTERNATIVE (ResCheck), 2009 IRC, SECTION N1102.1.3**

Submit a passing UA calculation (i.e. ResCheck) using 2009 IRC/IECC. The rating must be submitted at time of application and must include address of residence; name of individual completing the rating form; name & version of software tool (i.e. ResCheck). Air Sealing Checklist or Blower Door Test is required.

Circle one: Air Sealing Checklist Blower Door Test

☐ **(C)SIMULATED PERFORMANCE ALTERNATIVE, 2009 IECC, SECTION 405**

Current accredited programs: E-star of Colorado or Energylogic

HERS accredited energy rating system. **Must submit HERS index of 100 maximum.** A preliminary rating must be submitted at time of application and must include Address of residence; Name of individual completing the rating/compliance form; Name & version of software tool. Final rating requires a blower door test.

SIGN:	DATE:
CONTRACTOR:	PHONE:

Tools Prior to Submittal – Fort Collins, CO

Option (A) - Prescriptive

- Simple - specific to the exact climate zone
- Could include the U-Factor values as an option

(A)PRESCRIPTIVE compliance for house, 2009 IRC, section N1102.1, climate zone 5.

BUILDING ENVELOPE	INSULATION R-VALUE
Wood frame wall insul r-value	R-20 or 13+5ci
Metal frame wall insul r-value	R-13+9ci or R-19+8
Crawl space wall	R-13 or R-10ci
Roof insulation in attic	R-38
Roof rafter insulation	R-30
Walls below grade	R-13 / R-10ci
Wood floor over un-cond	R-30
Slab on grade floor, unheat	R-10, 24" DEEP
Windows	U-.35

Circle one: **Air Sealing Checklist** **Blower Door Test**

Tools Prior to Submittal – Fort Collins, CO

Option (B) – UA Alternative

☐	**(B)TOTAL UA ALTERNATIVE (ResCheck), 2009 IRC, SECTION N1102.1.3**
	Submit a passing UA calculation (i.e. ResCheck) using 2009 IRC/IECC. The rating must be submitted at time of application and must include address of residence; name of individual completing the rating form; name & version of software tool (i.e. ResCheck). Air Sealing Checklist or Blower Door Test is required.
	Circle one: Air Sealing Checklist Blower Door Test

Option (C) – Simulated Performance Alternative

☐	**(C)SIMULATED PERFORMANCE ALTERNATIVE, 2009 IECC, SECTION 405**
	Current accredited programs: E-star of Colorado or Energylogic
	HERS accredited energy rating system. **Must submit HERS index of 100 maximum.** A preliminary rating must be submitted at time of application and must include Address of residence; Name of individual completing the rating/compliance form; Name & version of software tool. Final rating requires a blower door test.

Tools Prior to Submittal – Jefferson County, CO

Residential Energy Code Submittal Requirements

The Jefferson County Division of Building Safety has adopted the 2009 International Codes effective January 1, 2010. Included as part of this adoption are the International Residential Code (IRC), and the International Energy Conservation Code (IECC). The IECC contains specific design and submittal requirements. The submittal requirements for residential energy compliance are outlined below as determined by the Division.

Energy code submittals shall be required for all residential projects in accordance with the applicable provisions of the 2009 IRC and 2009 IECC. There are four design path options available to the designer.

- Option #1: Prescriptive path as outlined in IRC Chapter 11
- Option #2: Total UA Alternative path (trade-off) as outlined in IRC section N1102.1.3 & IECC 402.1.4
- Option #3: Simulated Performance Alternative (Performance) path as outlined in IECC section 405
- Option #4: A Professional Design

Note: All four options have similar requirements for submittal documents to meet the code requirements including:

- Building envelope information
- A Manual J equipment design in accordance with the IRC section M1401.3
- A Manual D duct design in accordance with the IRC section M1601.1

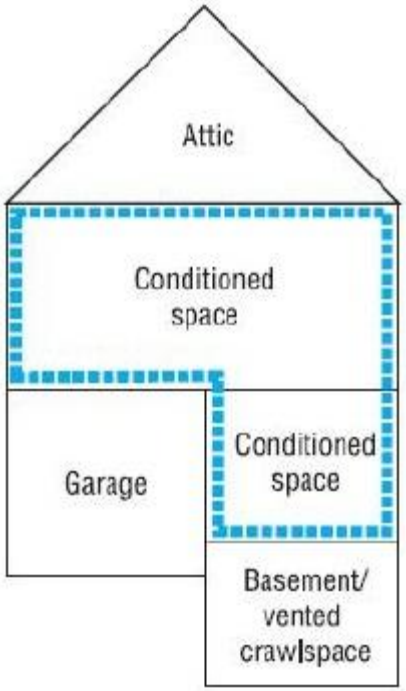
Tools Prior to Submittal – Jefferson County, CO

Option #1 Prescriptive Path

The Prescriptive Path requirements for the building envelope are found in Chapter 11 of the 2009 IRC. Unincorporated Jefferson County is located in Climate Zone 5, as shown in Figure & Table N1102.1. All prescriptive information shall be taken from the various tables using Zone 5 requirements.

The Prescriptive Building Envelope submittal shall include, at the minimum, the following information on the submitted plans.

- Address of the building (this is a site specific submittal)
- Define/ Delineate your Building Thermal Envelope (this information is required to be on the plans rather than a separate document)
- Insulation materials; R values denoted for each individual area (wall, ceiling, floor over garage, etc.)
- Crawl space insulation for structural floors and other crawl space areas. (Specify whether the foundation wall or the structural floor system is to be insulated. See requirements of section N1102.2.9)
- Fenestration U factors 402.3
- Duct sealing and insulation. 403.2
- Manual J, specific to the site
- Manual D duct design, specific to the building
- Lighting equipment 404.1
- Specific insulation 402.2



MISSOURI DEPARTMENT OF NATURAL RESOURCES

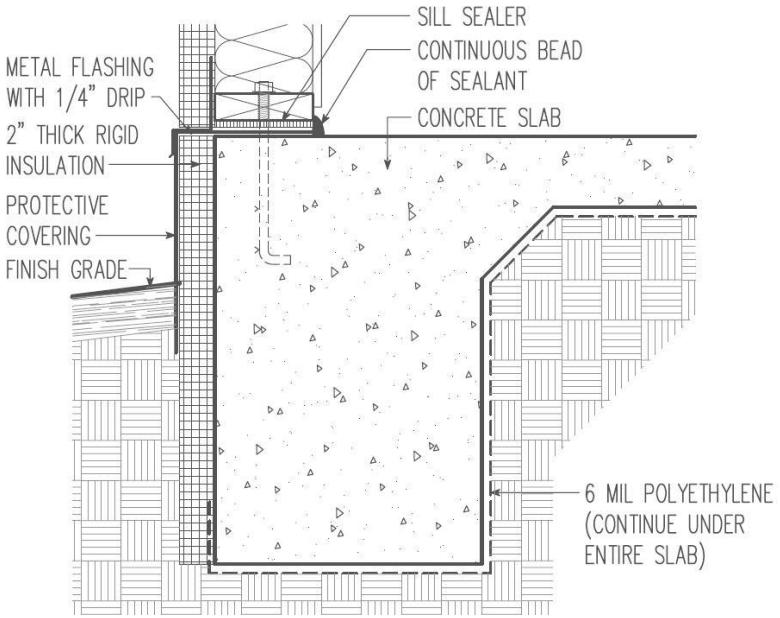
Tools Prior to Submittal

All projects should include:

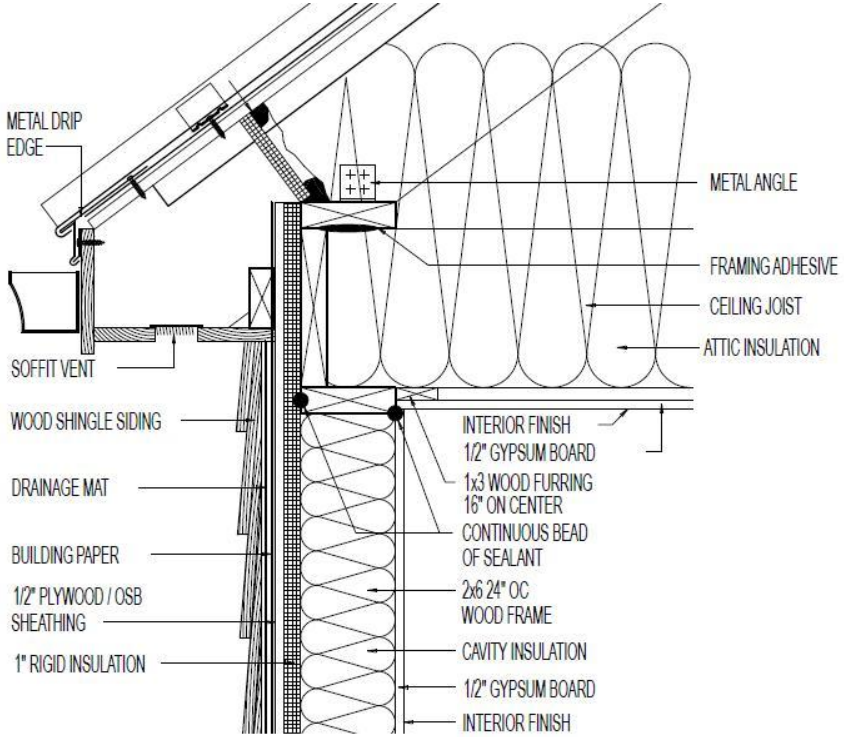
- Air sealing details to limit air infiltration
- Air barrier and insulation notes (air barriers at *all* installed insulation)
- Duct sealing notes, note that no stud cavity shall be used as a ducts, and possibly duct insulation notes
- Mechanical equipment details (type, efficiency, venting, location, etc.)

Tools Prior to Submittal

Example Building Sections



Foundation/floor connection



Wall/roof connection

http://www.greenbuildingadvisor.com

Tools Prior to Submittal – Prescriptive (R-Value)

Prescriptive Pathway

- Mandatory notes
- Wall Sections specifying insulation
- Insulation schedule
- High-efficacy lighting

Efficiency Schedule

Energy Details - Climate Zone 4	
2012 IECC Compliance - Prescriptive	
Basement Walls	2x4 with R-13 cav. (FB)
Above Grade Walls	2x6 with R-20 cav (BC)
Floor Over Garage	11.875" TJ with R-43 cav (BC)
Ceiling - Attic	R-50 (BC)
Windows	All U-Factors equal or below 0.30
Lighting	75% or more to be CFL

FB - Fiberglass Batt (R-3.7/inch)

BC - Blown Cellulose (R-3.66/inch)

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Tools Prior to Submittal – Prescriptive (U-Factor)

U-Factor Pathway

- Mandatory notes
- Wall Sections specifying insulation
- Insulation schedule
- High-efficacy lighting

Efficiency Schedule

Energy Details - Climate Zone 4	
2012 IECC Compliance - Prescriptive/U-Factor	
Basement Walls	2x4 with R-13 cav (FB)
Above Grade Walls	2x4 with empty cav and 2" of PI Foam on exterior [U-Factor - 0.057]
Floor Over Garage	11.875" TJ with R-43 cav (BC)
Ceiling - Attic	R-50 (BC)
Windows	All U-Factors equal or below 0.30
Lighting	75% or more to be CFL

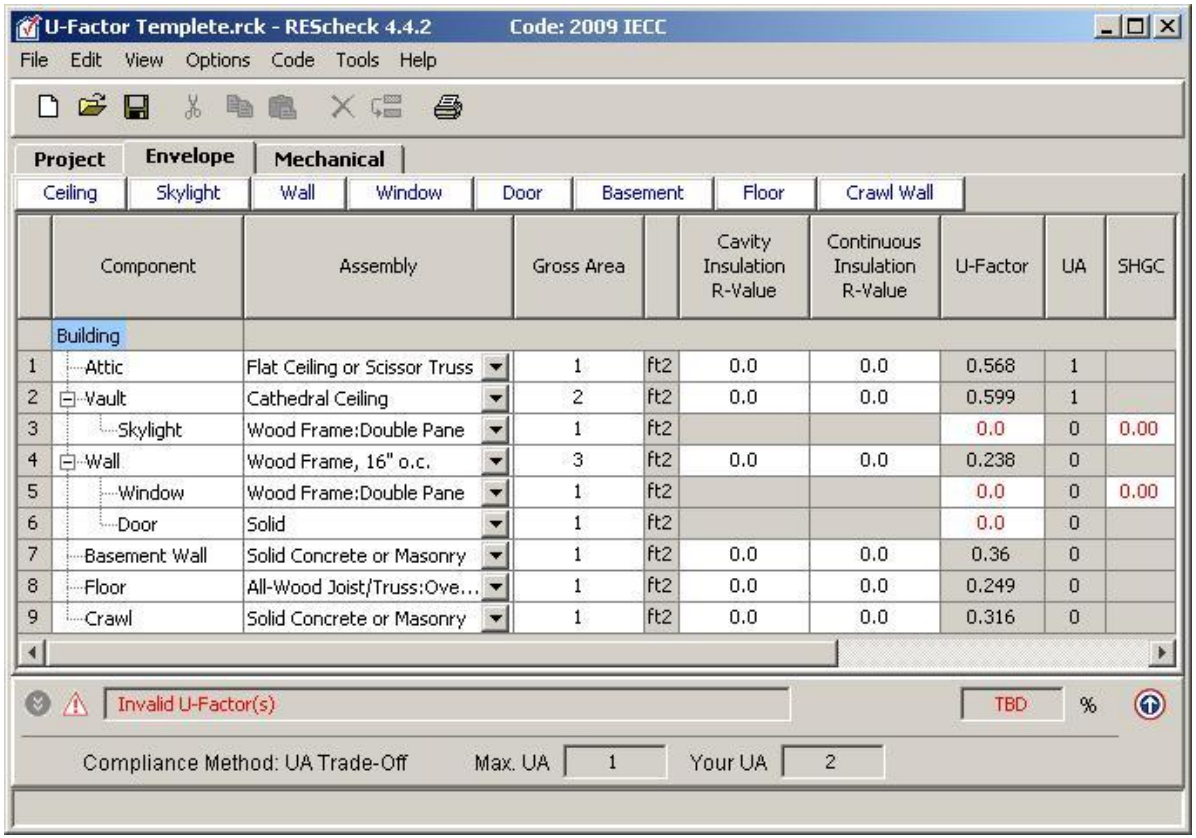
FB - Fiberglass Batt (R-3.7/inch)
BC - Blown Cellulose (R-3.66/inch)
PI - Polyisocyanurate Rigid Foam (R-6.5/inch)

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Tools Prior to Submittal – Prescriptive (U-Factor)

Could use REScheck as a template also

- Automatically calculates the U-Factor of an assembly



Tools Prior to Submittal – UA Alternative

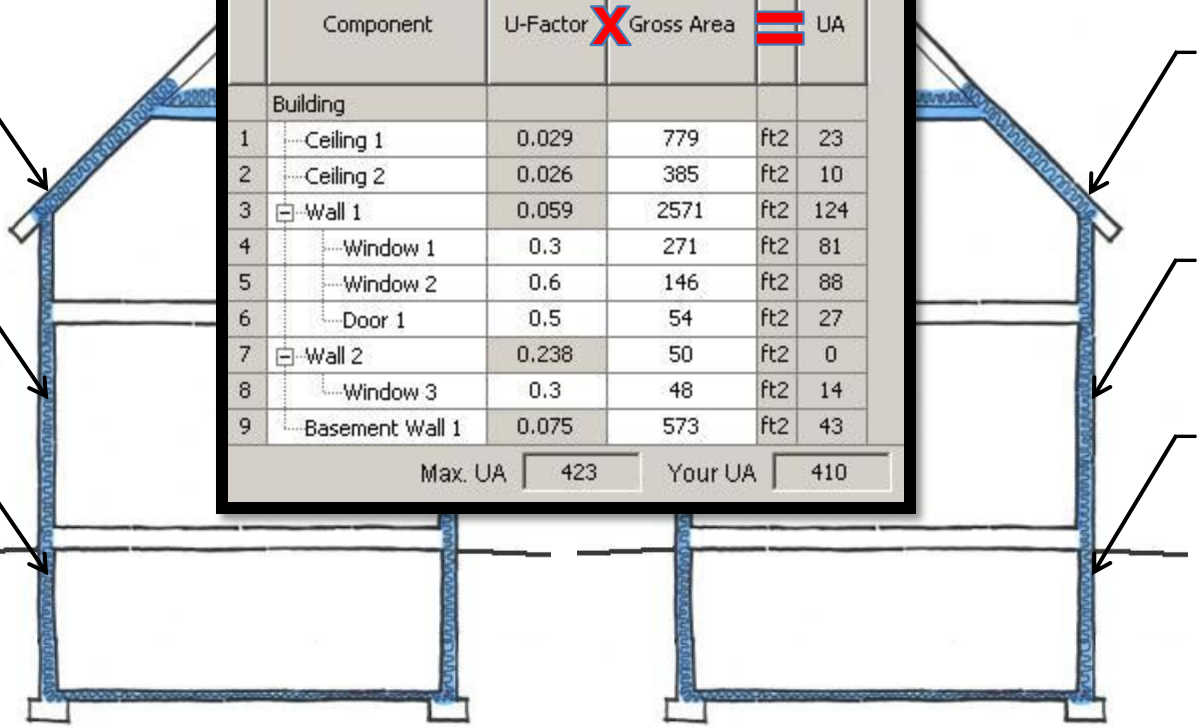
Vaulted Ceiling
U-Factor – 0.026
Eq. to R-49 cav

ABG Walls
U-Factor – 0.057
Eq. to R-20 cav

Basement Walls
U-Factor – 0.059
Eq. to R-13 cav

	Component	U-Factor	X	Gross Area	=	UA
	Building					
1	Ceiling 1	0.029		779	ft2	23
2	Ceiling 2	0.026		385	ft2	10
3	Wall 1	0.059		2571	ft2	124
4	Window 1	0.3		271	ft2	81
5	Window 2	0.6		146	ft2	88
6	Door 1	0.5		54	ft2	27
7	Wall 2	0.238		50	ft2	0
8	Window 3	0.3		48	ft2	14
9	Basement Wall 1	0.075		573	ft2	43

Max. UA 423 Your UA 410



Vaulted Ceiling
2x12 w/ R-49 cav

AGW Walls
2x6 w/ R-21 cav

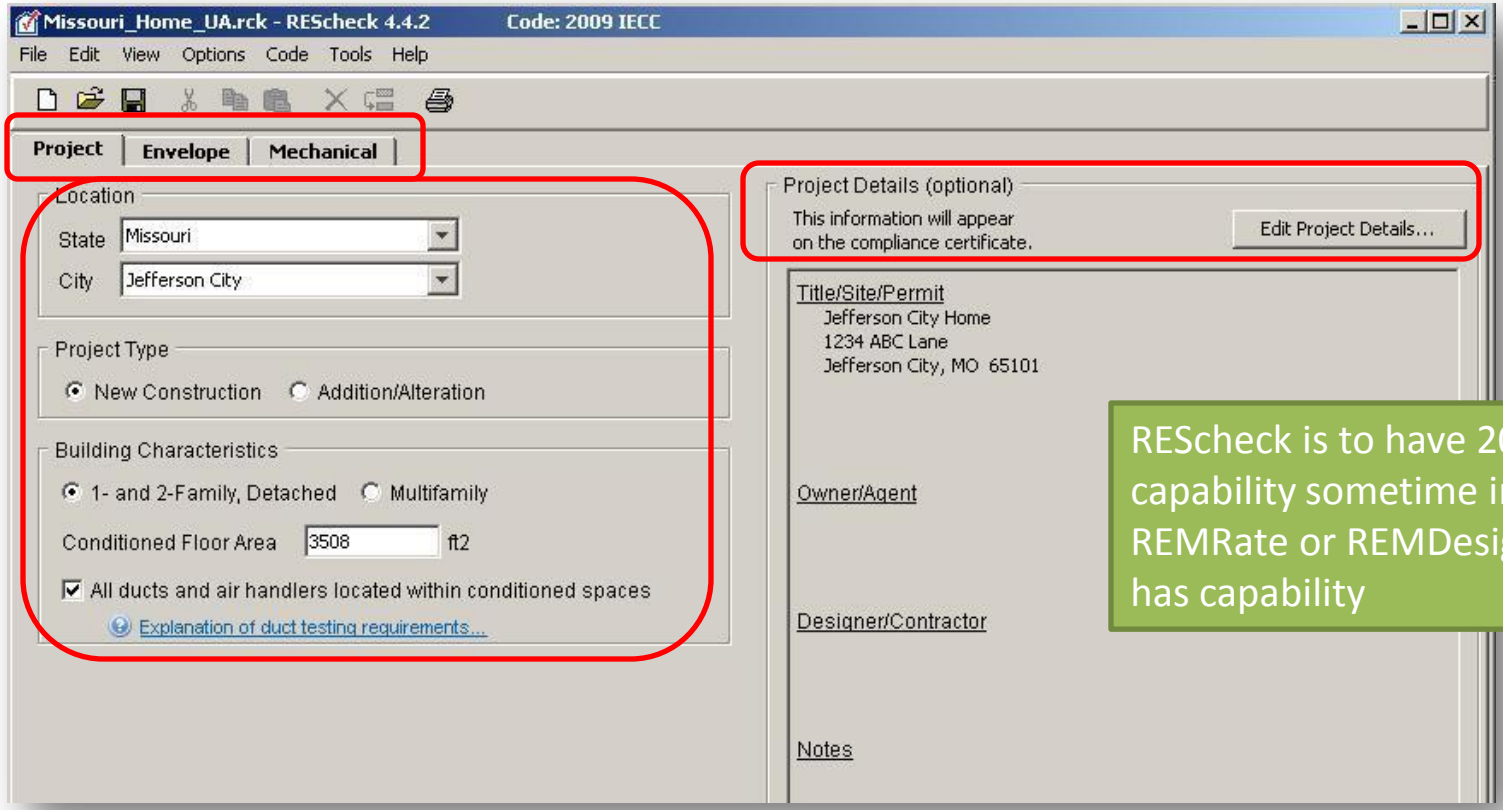
Basement Walls
2x4 w/ R-13 cav

Max UA

Design UA

MISSOURI DEPARTMENT OF NATURAL RESOURCES

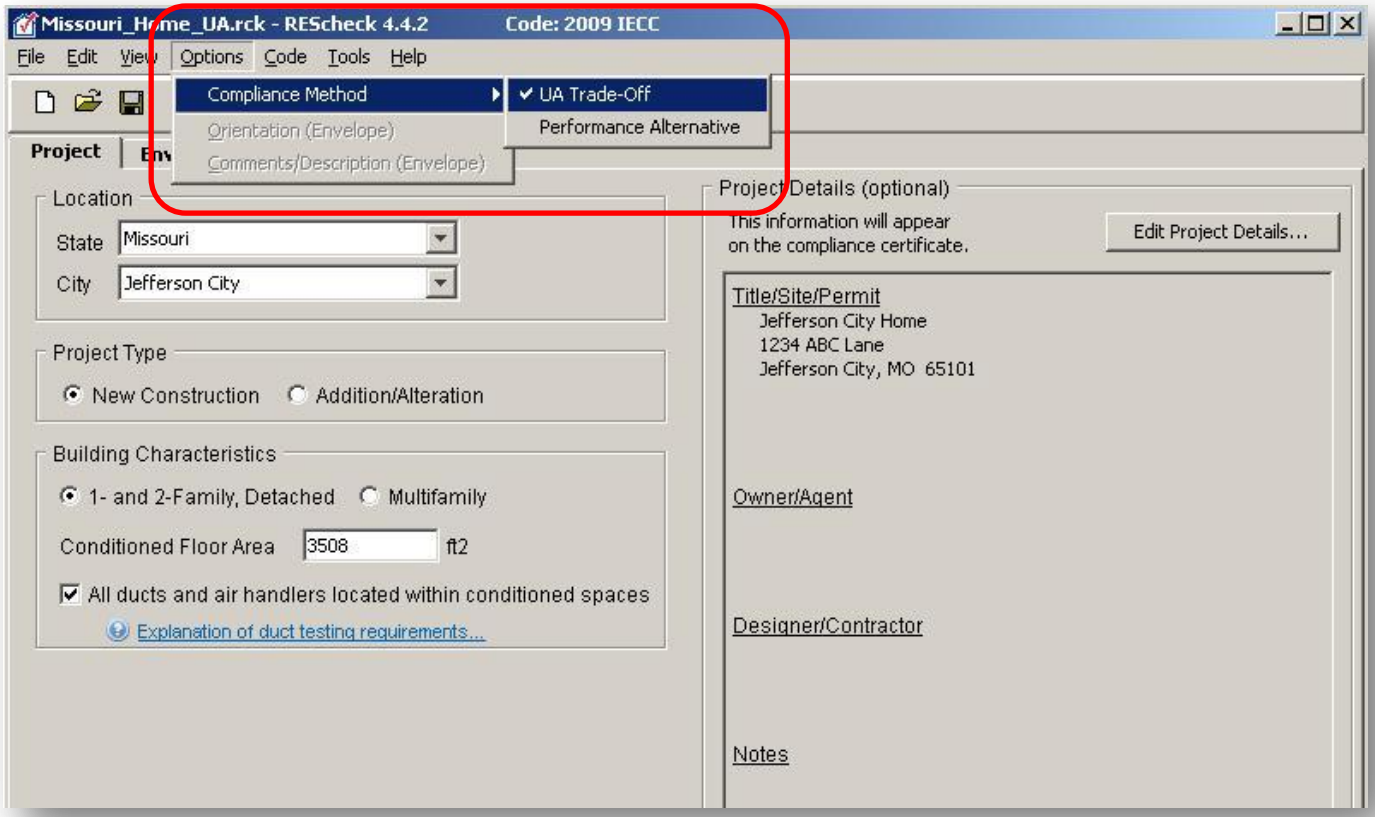
Tools Prior to Submittal – UA Alternative



REScheck™

REScheck is to have 2012 capability sometime in February REMRate or REMDesign already has capability

Tools Prior to Submittal – UA Alternative



Tools Prior to Submittal – UA Alternative

Missouri_Home_UA.rck - REScheck 4.4.2 Code: 2009 IECC

File Edit View Options Code Tools Help

Project | Envelope | Mechanical

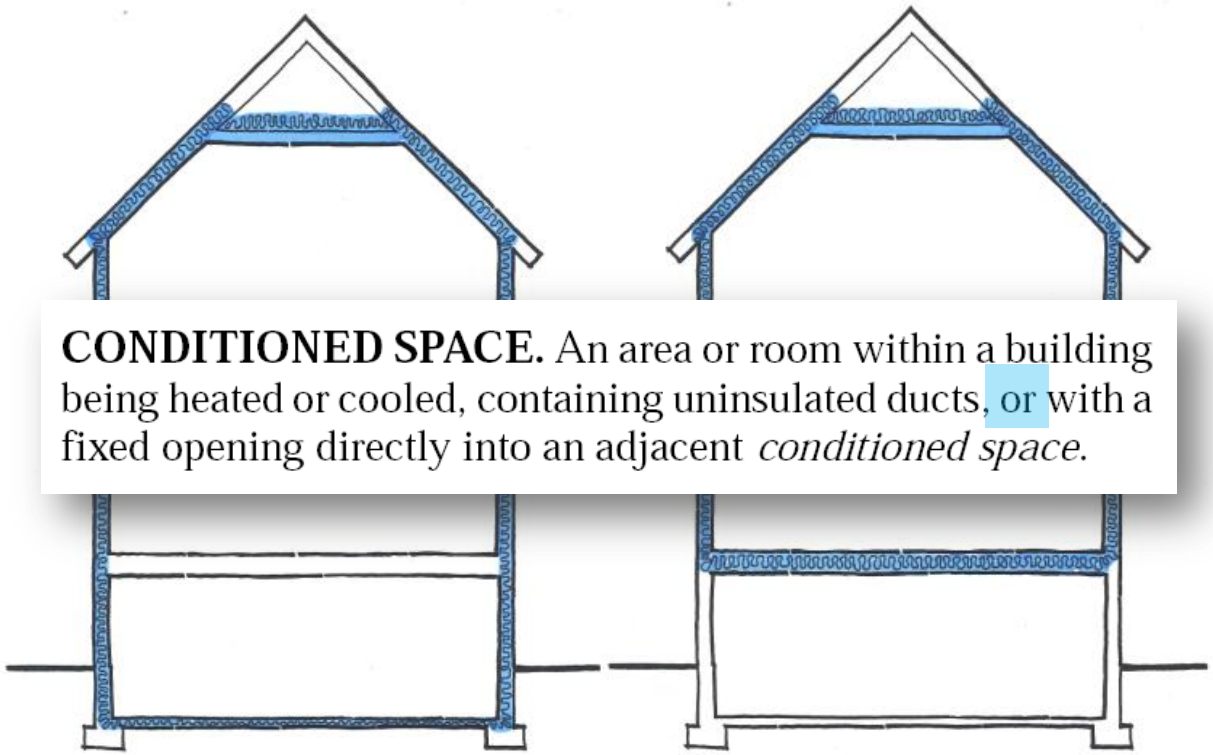
Ceiling | Skylight | Wall | Window | Door | Basement | Floor | Crawl Wall

	Component	Assembly	Gross Area		Cavity Insulation R-Value	Continuous Insulation R-Value	U-Factor	UA	SHGC	Wall Height (ft)
	Building									
1	Ceiling 1	Cathedral Ceiling	779	ft2	30.0	5.0	0.029	23		
2	Ceiling 2	Flat Ceiling or Scissor Truss	385	ft2	25.0	13.0	0.026	10		
3	Wall 1	Wood Frame, 16" o.c.	2571	ft2	20.0	0.0	0.059	124		
4	Window 1	Wood Frame:Double Pan...	271	ft2			0.3	81	0.40	
5	Window 2	Wood Frame:Double Pan...	146	ft2			0.6	88	0.50	
6	Door 1	Solid	54	ft2			0.5	27		
7	Wall 2	Wood Frame, 16" o.c.	50	ft2	0.0	0.0	0.238	0		
8	Window 3	Wood Frame:Double Pan...	48	ft2			0.3	14	0.40	
9	Basement Wall 1	Solid Concrete or Masonry	573	ft2	13.0	0.0	0.075	43		7.0

REScheck™

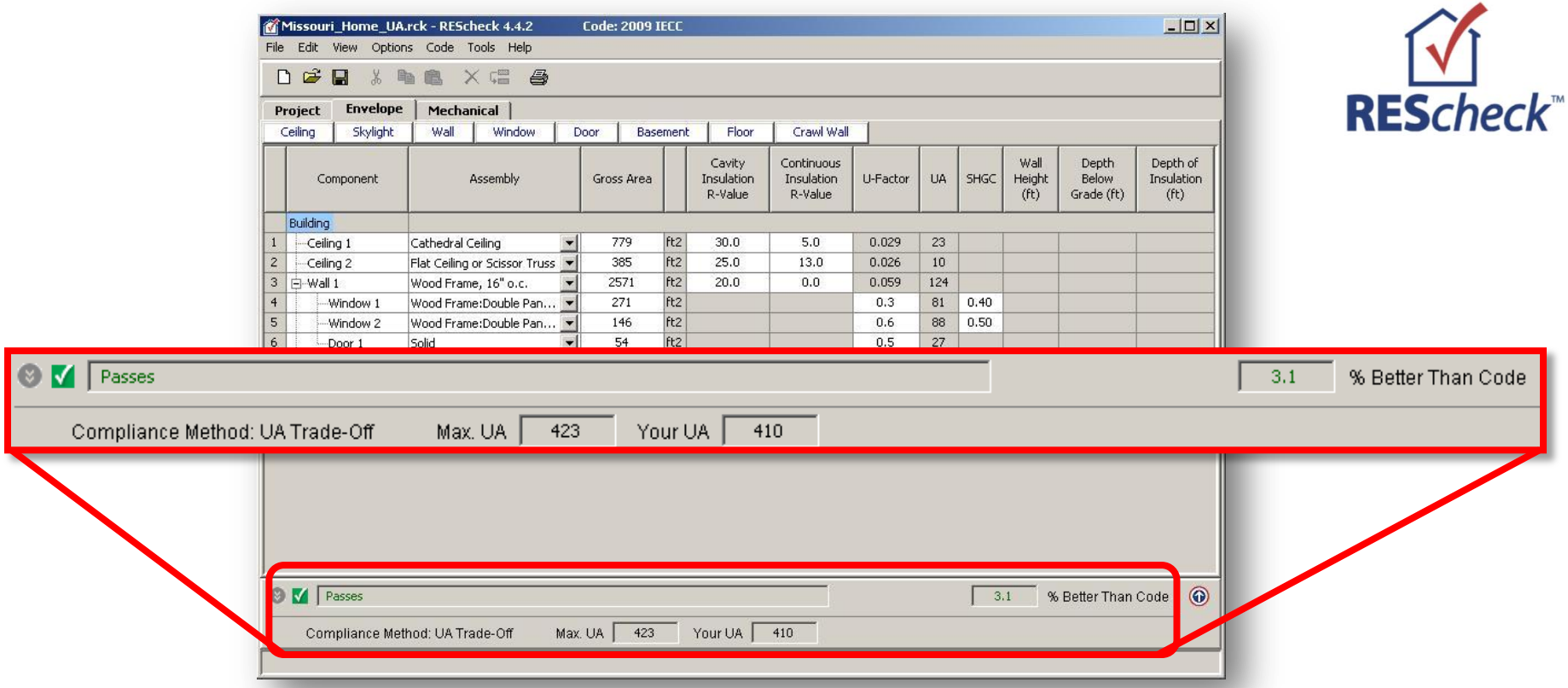
MISSOURI DEPARTMENT OF NATURAL RESOURCES

Tools Prior to Submittal – UA Alternative

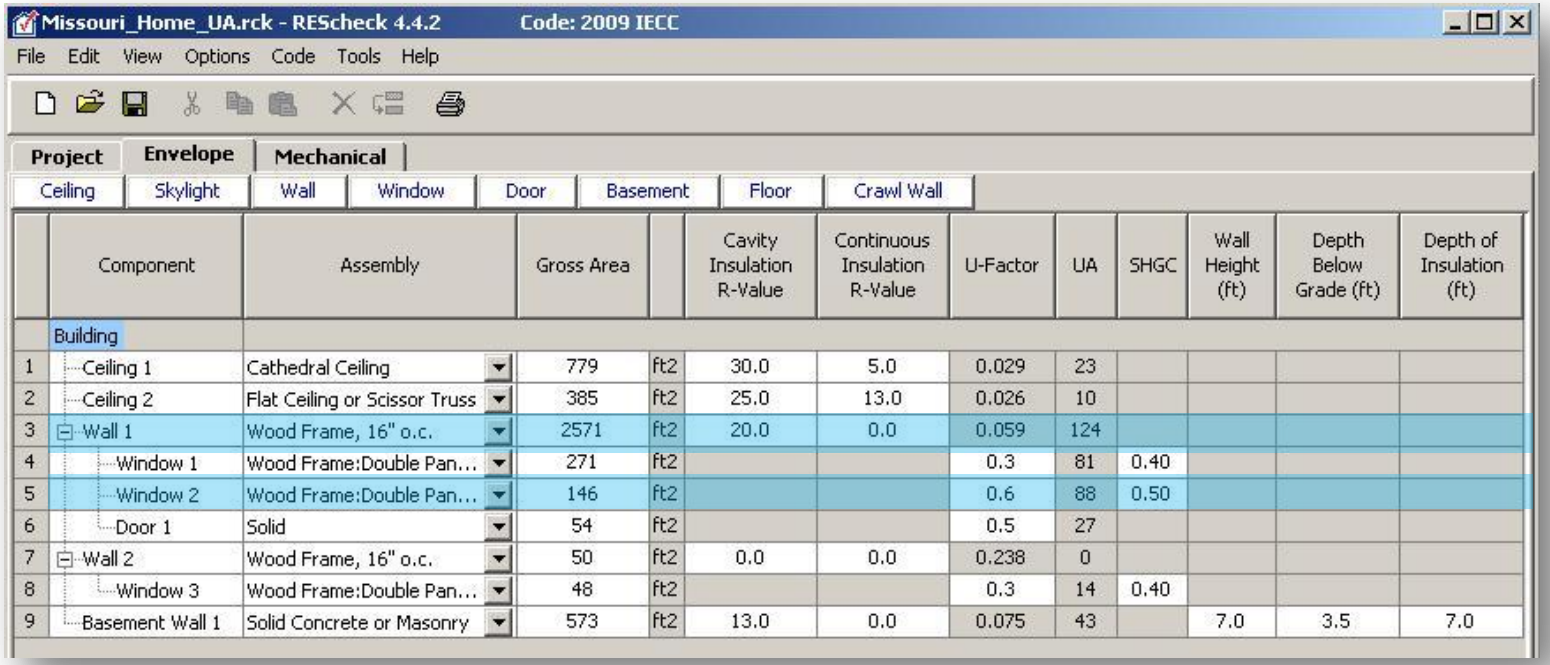


CONDITIONED SPACE. An area or room within a building being heated or cooled, containing uninsulated ducts, or with a fixed opening directly into an adjacent *conditioned space*.

Tools Prior to Submittal – UA Alternative

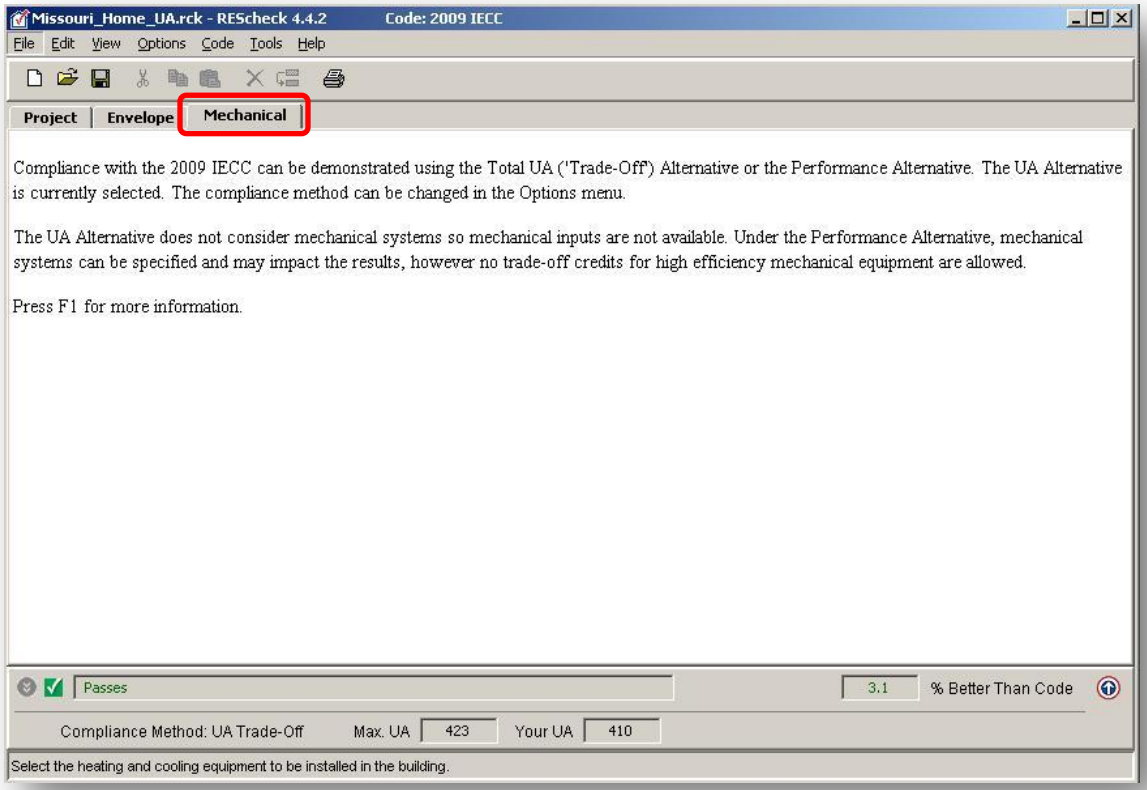


Tools Prior to Submittal – UA Alternative



	Component	Assembly	Gross Area		Cavity Insulation R-Value	Continuous Insulation R-Value	U-Factor	UA	SHGC	Wall Height (ft)	Depth Below Grade (ft)	Depth of Insulation (ft)
	Building											
1	Ceiling 1	Cathedral Ceiling	779	ft2	30.0	5.0	0.029	23				
2	Ceiling 2	Flat Ceiling or Scissor Truss	385	ft2	25.0	13.0	0.026	10				
3	Wall 1	Wood Frame, 16" o.c.	2571	ft2	20.0	0.0	0.059	124				
4	Window 1	Wood Frame:Double Pan...	271	ft2			0.3	81	0.40			
5	Window 2	Wood Frame:Double Pan...	146	ft2			0.6	88	0.50			
6	Door 1	Solid	54	ft2			0.5	27				
7	Wall 2	Wood Frame, 16" o.c.	50	ft2	0.0	0.0	0.238	0				
8	Window 3	Wood Frame:Double Pan...	48	ft2			0.3	14	0.40			
9	Basement Wall 1	Solid Concrete or Masonry	573	ft2	13.0	0.0	0.075	43		7.0	3.5	7.0

Tools Prior to Submittal – UA Alternative



REScheck™

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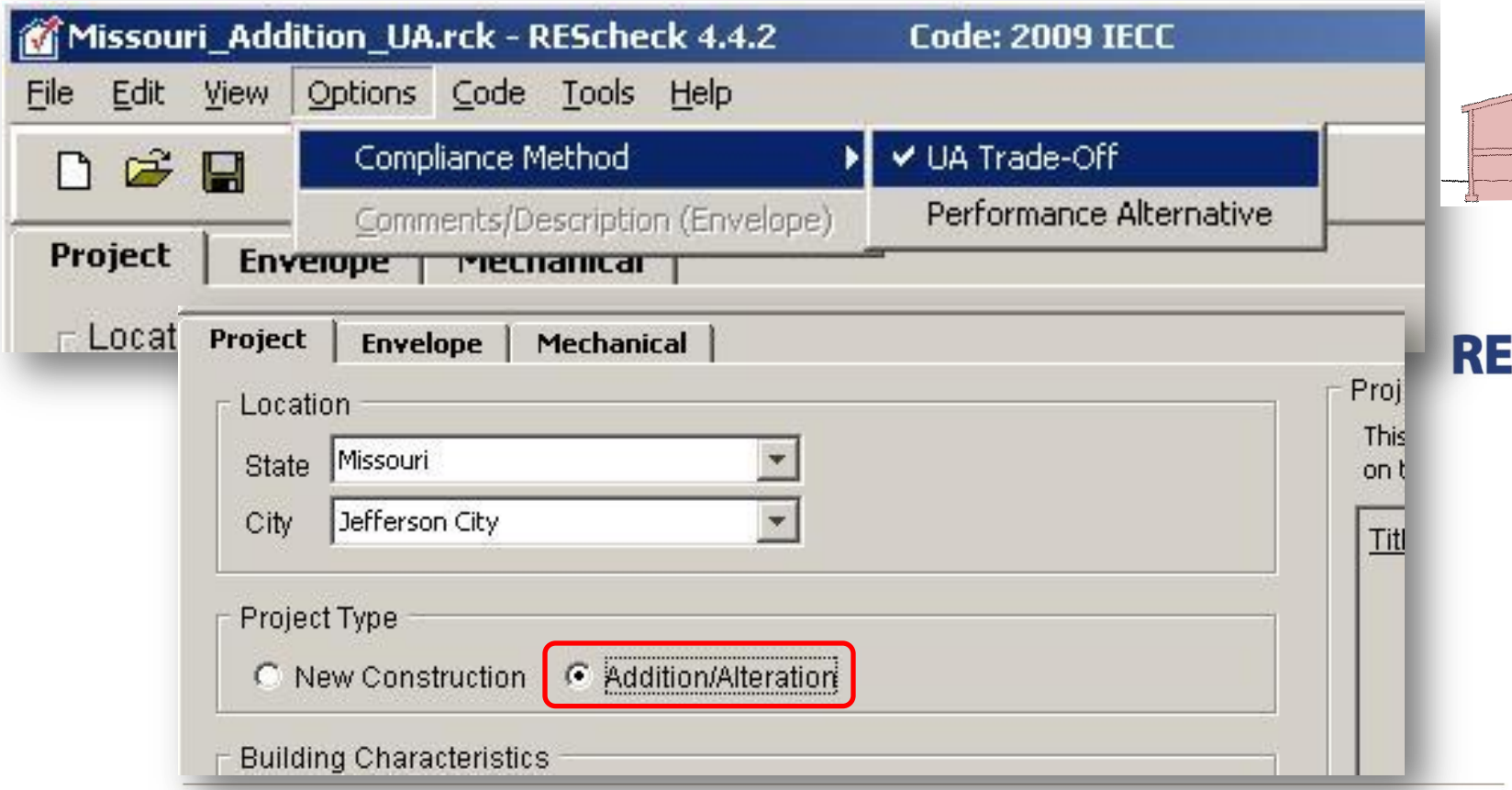
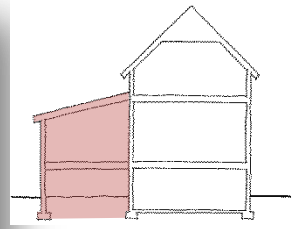
Tools Prior to Submittal – UA Alternative





REScheck™

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Tools Prior to Submittal – UA Alternative

Missouri_Addition_UA.rck - REScheck 4.4.2 Code: 2009 IECC

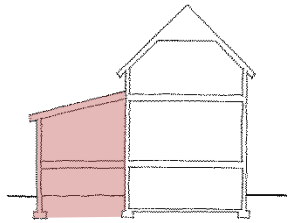
File Edit View Options Code Tools Help

Project | Envelope | Mechanical

Ceiling | Skylight | Wall | Window | Door | Basement | Floor | Crawl Wall

	Component	Post-Alteration Assembly	Alteration Details	Gross Area		Cavity Insulation R-Value	Continuous Insulation R-Value	Proposed U-Factor	UA	Wall Height (ft)	Depth Below Grade (ft)	Depth of Insulation (ft)
	Building											
1	Ceiling 1	Cathedral Ceiling	No exemptions apply	779	ft2	30.0	5.0	0.029	23			
2	Ceiling 2	Flat Ceiling or Scissor Truss	No exemptions apply	385	ft2	25.0	13.0	0.026	10			
3	Wall 1	Wood Frame, 16" o.c.	No exemptions apply	2571	ft2	20.0	0.0	0.059	124			
4	Window 1	Wood Frame:Double Pan...	No exemptions apply	271	ft2			0.3	81			
5	Window 2	Wood Frame:Double Pan...	No exemptions apply	146	ft2			0.6	88			
6	Door 1	Solid	No exemptions available	54	ft2			0.5	27			
7	Wall 2	Wood Frame, 16" o.c.	No exemptions apply	50	ft2	0.0	0.0	0.238	0			
8	Window 3	Wood Frame:Double Pan...	No exemptions apply	48	ft2			0.3	14			
9	Basement Wall 1	Solid Concrete or Masonry	No exemptions apply	573	ft2	13.0	0.0	0.075	43	7.0	3.5	7.0

Compliance: Passes | Max. UA: 423 | Your UA: 410 | 3.1 % Better Than Code



REScheck™

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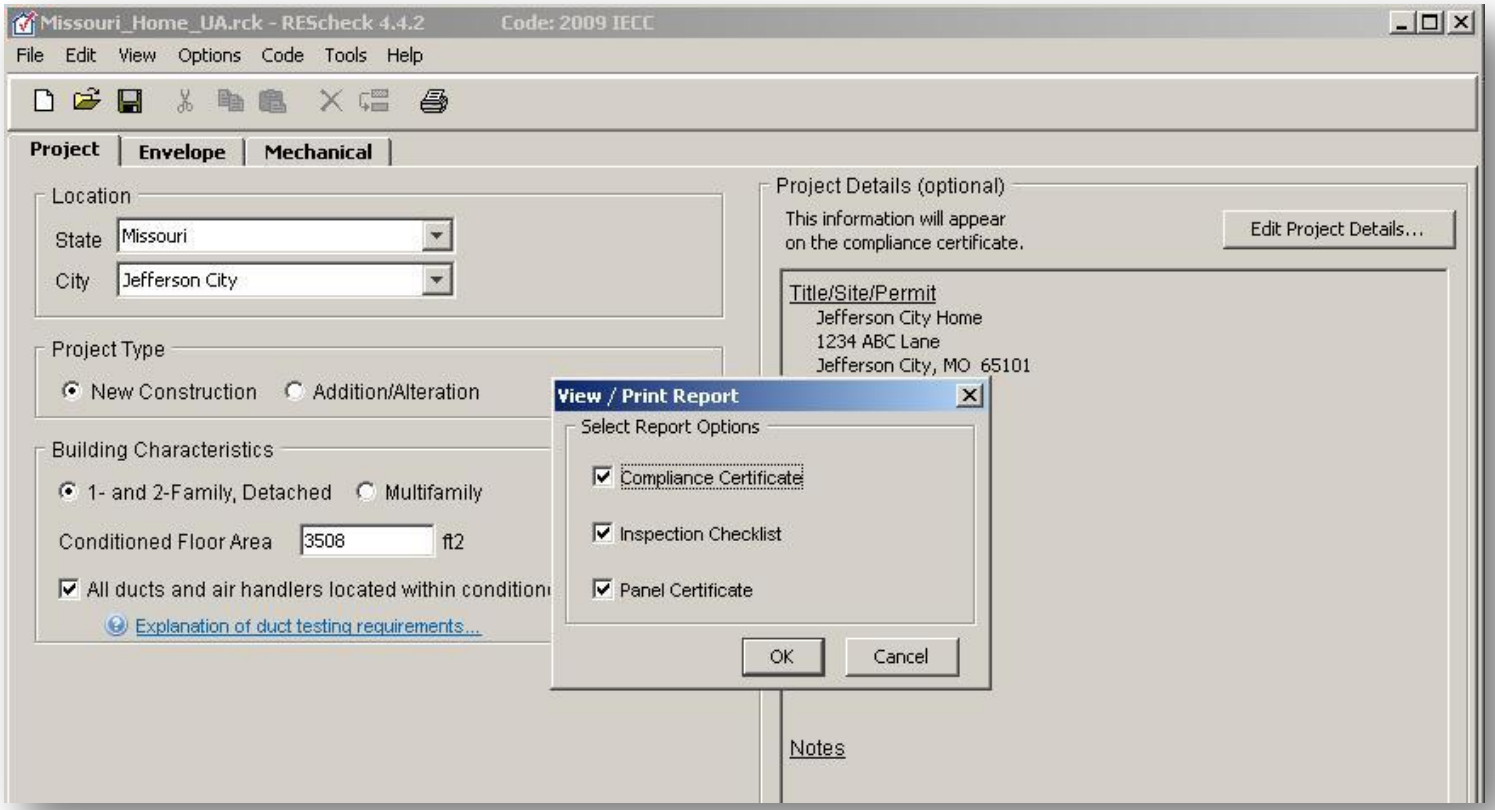
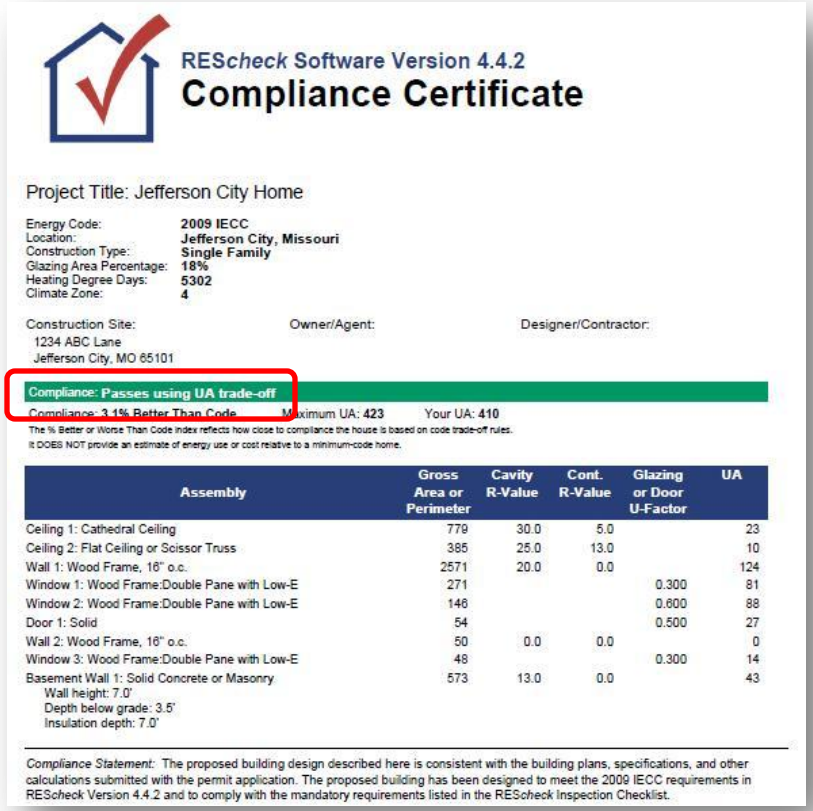
Tools Prior to Submittal – UA Alternative



Tools Prior to Submittal – UA Alternative



REScheck Software Version 4.4.2

Compliance Certificate

Project Title: Jefferson City Home

Energy Code: 2009 IECC
Location: Jefferson City, Missouri
Construction Type: Single Family
Glazing Area Percentage: 18%
Heating Degree Days: 5302
Climate Zone: 4

Construction Site:
1234 ABC Lane
Jefferson City, MO 65101

Owner/Agent:

Designer/Contractor:

Compliance: Passes using UA trade-off

Compliance: 3.1% Better Than Code Maximum UA: 423 Your UA: 410

The % Better or Worse Than Code index reflects how close to compliance the house is based on code trade-off rules.
It DOES NOT provide an estimate of energy use or cost relative to a minimum-code home.

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Cathedral Ceiling	779	30.0	5.0		23
Ceiling 2: Flat Ceiling or Scissor Truss	385	25.0	13.0		10
Wall 1: Wood Frame, 16" o.c.	2571	20.0	0.0		124
Window 1: Wood Frame:Double Pane with Low-E	271			0.300	81
Window 2: Wood Frame:Double Pane with Low-E	146			0.600	88
Door 1: Solid	54			0.500	27
Wall 2: Wood Frame, 16" o.c.	50	0.0	0.0		0
Window 3: Wood Frame:Double Pane with Low-E	48			0.300	14
Basement Wall 1: Solid Concrete or Masonry Wall height: 7.0' Depth below grade: 3.5' Insulation depth: 7.0'	573	13.0	0.0		43

Compliance Statement: The proposed building design described here is consistent with the building plans, specifications, and other calculations submitted with the permit application. The proposed building has been designed to meet the 2009 IECC requirements in REScheck Version 4.4.2 and to comply with the mandatory requirements listed in the REScheck Inspection Checklist.

REScheck™

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Tools Prior to Submittal – UA Alternative

REScheck Software Version 4.4.2
Inspection Checklist

Ceilings:

☐ Ceiling 1: Cathedral Ceiling, R-30.0 cavity + R-5.0 continuous insulation
Comments: _____

☐ Ceiling 2: Flat Ceiling or Scissor Truss, R-25.0 cavity + R-13.0 continuous insulation
Comments: _____

Above-Grade Walls:

☐ Wall 1: Wood Frame, 16" o.c., R-20.0 cavity insulation
Comments: _____

☐ Wall 2: Wood Frame, 16" o.c., R-0 (uninsulated)
Comments: _____

Basement Walls:

☐ Basement Wall 1: Solid Concrete or Masonry, 7.0' ht / 3.5' bg / 7.0' insul, R-13.0 cavity insulation
Comments: _____

Windows:

☐ Window 1: Wood Frame:Double Pane with Low-E, U-factor: 0.300
For windows without labeled U-factors, describe features:
#Panes ____ Frame Type _____ Thermal Break? ____ Yes ____ No
Comments: _____

☐ Window 2: Wood Frame:Double Pane with Low-E, U-factor: 0.600
For windows without labeled U-factors, describe features:
#Panes ____ Frame Type _____ Thermal Break? ____ Yes ____ No
Comments: _____

☐ Window 3: Wood Frame:Double Pane with Low-E, U-factor: 0.300

Tools Prior to Submittal – UA Alternative

2009 IECC Energy Efficiency Certificate

Insulation Rating	R-Value
Ceiling / Roof	35.00
Wall	20.00
Floor / Foundation	13.00
Ductwork (unconditioned spaces):	_____

Glass & Door Rating	U-Factor	SHGC
Window	0.30	0.40
Door	0.50	NA

Heating & Cooling Equipment	Efficiency
Heating System:_____	_____
Cooling System:_____	_____
Water Heater:_____	_____

Name:_____ Date:_____

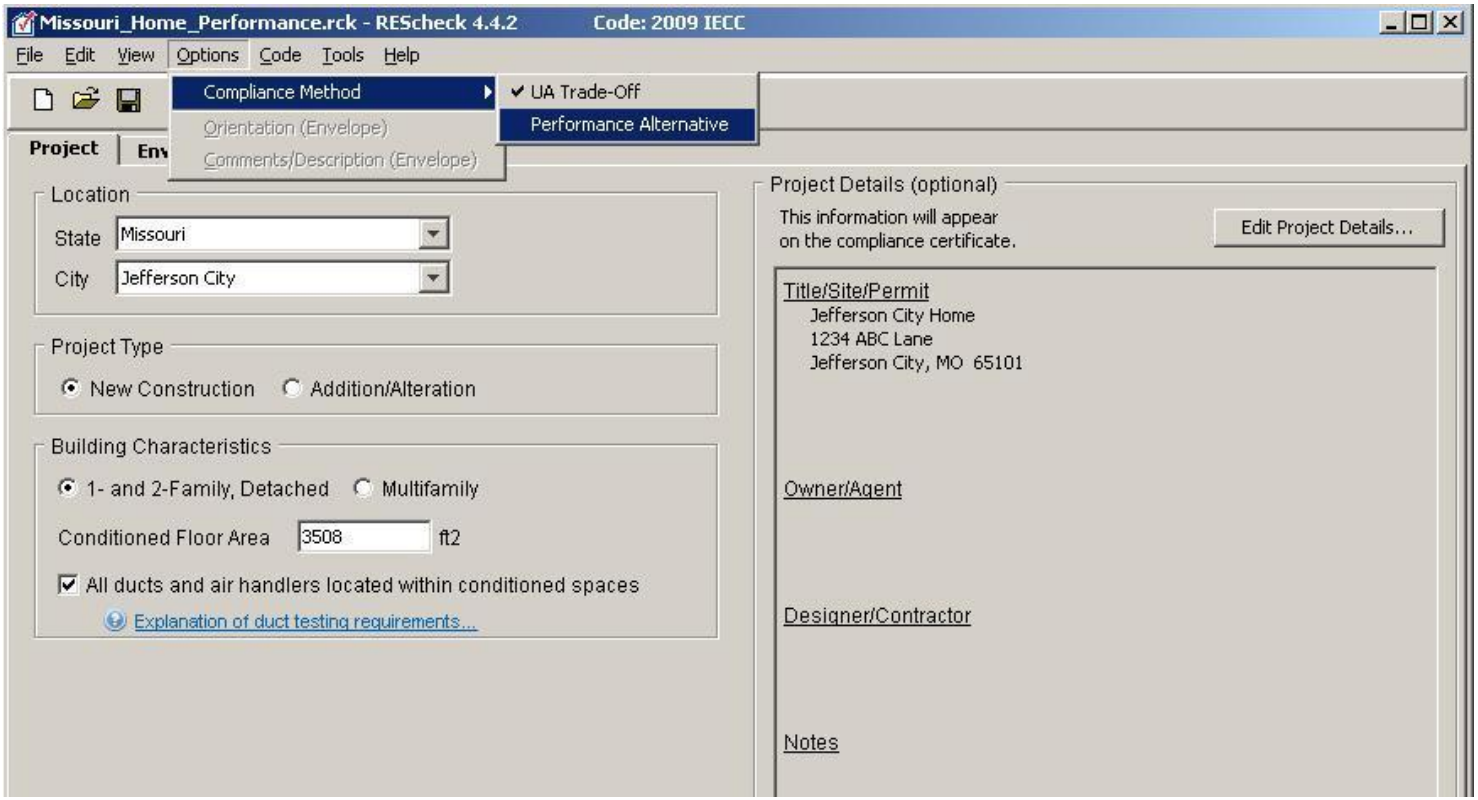
Comments:

REScheck™

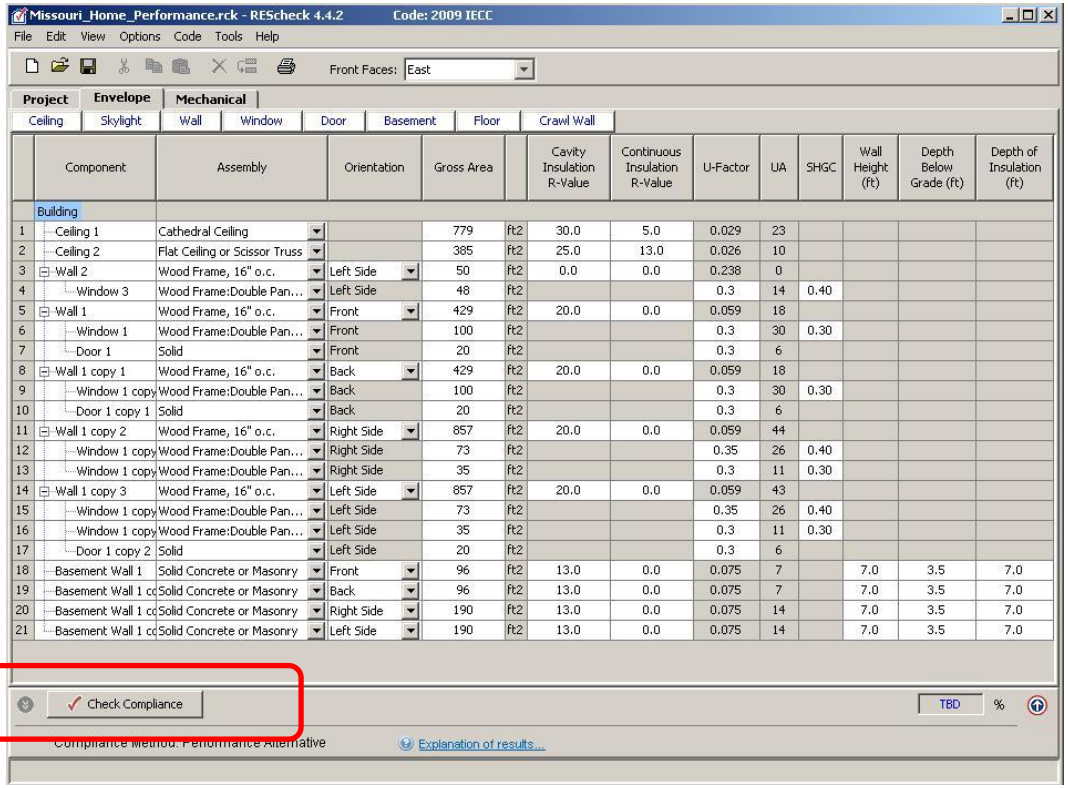
Tools Prior to Submittal – Simulated Performance

- REScheck
- REM/Design or REM/Rate

Tools Prior to Submittal – Simulated Performance



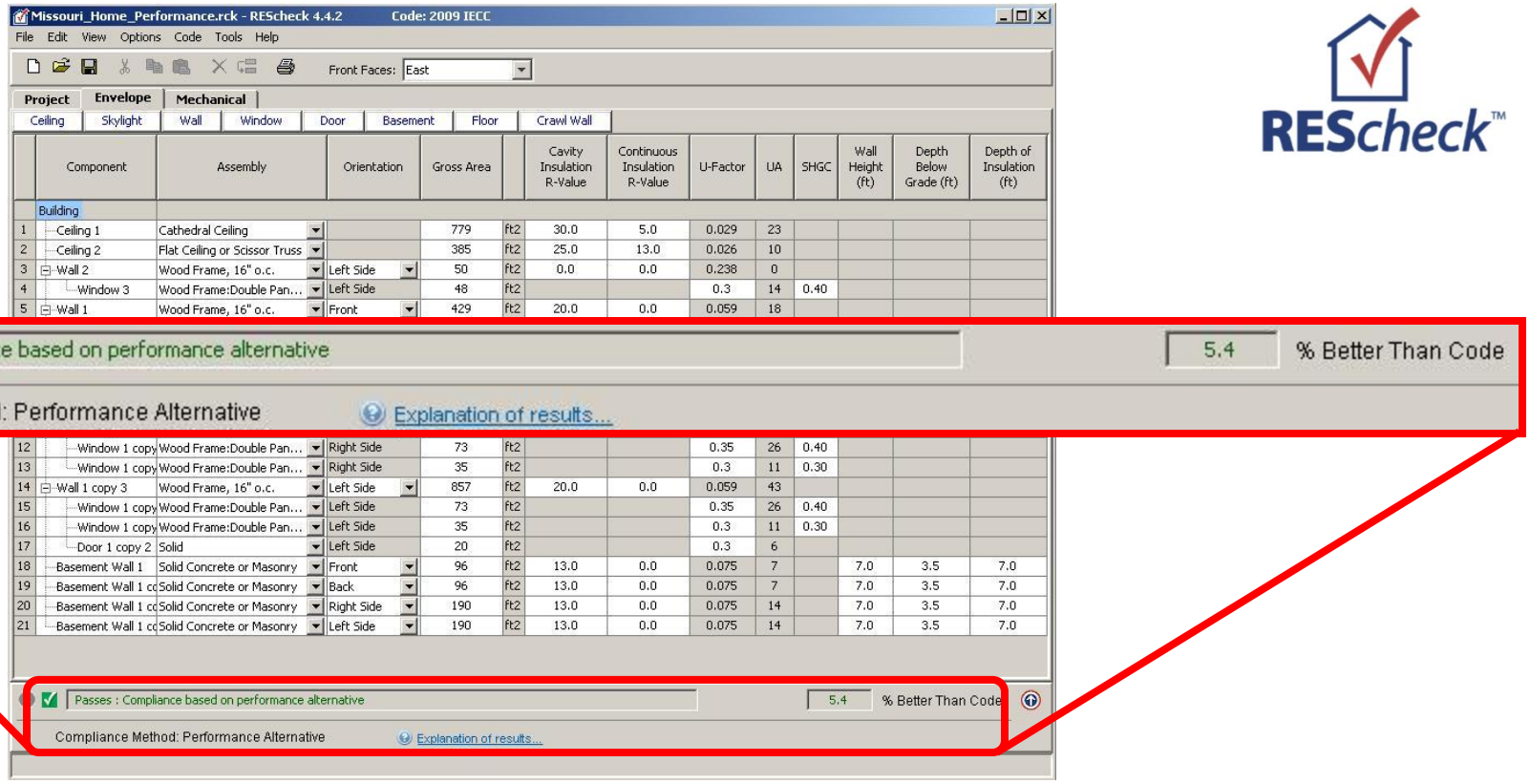
Tools Prior to Submittal – Simulated Performance



RESCheck™

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Tools Prior to Submittal – Simulated Performance



REScheck™

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Tools Prior to Submittal – Simulated Performance

RES*check* Software Version 4.4.2

Compliance Certificate

REScheck™

Project Title: Jefferson City Home

Energy Code:	**2009 IECC**
Location:	**Jefferson City, Missouri**
Construction Type:	**Single Family**
Building Orientation:	**Bldg. faces 90 deg. from North**
Conditioned Floor Area:	**3508 ft2**
Glazing Area Percentage:	**18%**
Heating Degree Days:	**5302**
Climate Zone:	**4**

Construction Site:
1234 ABC Lane
Jefferson City, MO 65101

Owner/Agent:

Designer/Contractor:

Compliance: **Passes using performance alternative**

Compliance: **5.4% Better Than Code**

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Cathedral Ceiling	779	30.0	5.0		23
Ceiling 2: Flat Ceiling or Scissor Truss	385	25.0	13.0		10

MISSOURI DEPARTMENT OF NATURAL RESOURCES

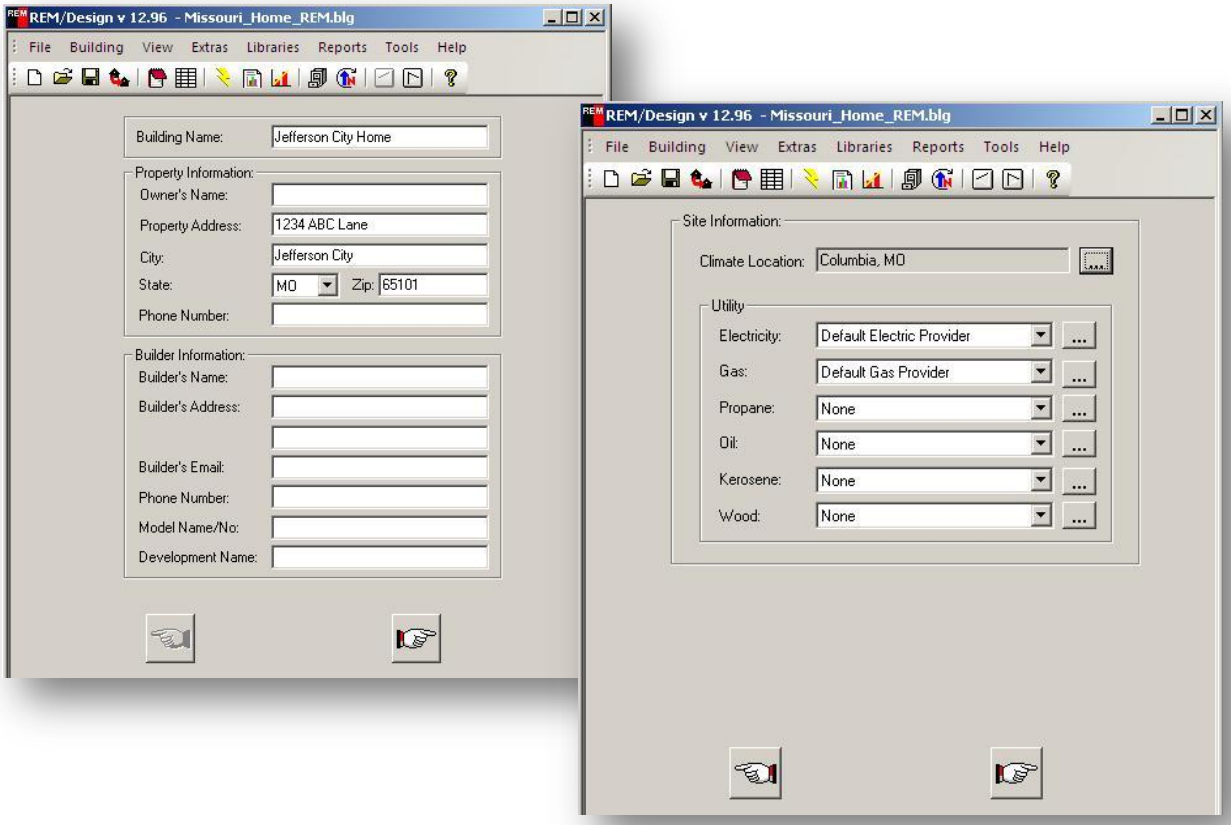
Tools Prior to Submittal – Simulated Performance

- REScheck [405.6.1] minimum capabilities of the software
- REM/Design or REM/Rate

BEST PRACTICE: HERS rating - standard for:

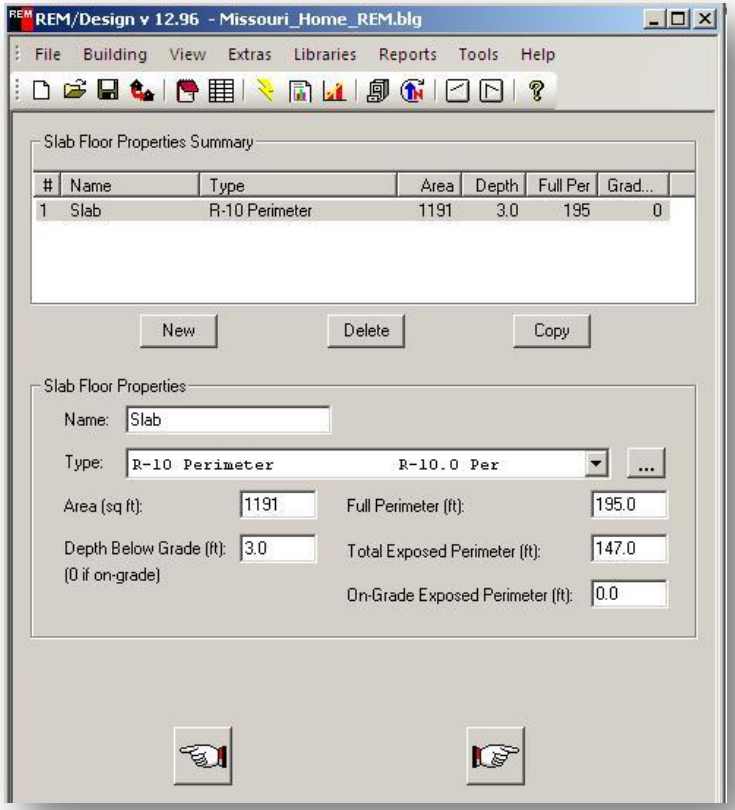
- ENERGY STAR
- LEED
- Tax rebates

Tools Prior to Submittal – Simulated Performance



REM/Design™

Tools Prior to Submittal – Simulated Performance



REM/Design™

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Tools Prior to Submittal – Simulated Performance

REM/Design™

2009 IECC ANNUAL ENERGY COST COMPLIANCE

Building Name:	Jefferson City Home	Date:	November 18, 2011
Owner's Name:		Builder's Name:	
Property	1234 ABC Lane	Weather Site:	Columbia, MO
Address:	Jefferson City, MO 65101	File Name:	Missouri_Home_REM.blg

	Annual Energy Cost ($)	
	2009 IECC	**As Designed**
Heating:	583	493
Cooling:	239	208
Water Heating:	95	70
SubTotal - Used to Determine Compliance:	**917**	**770**
Lights & Appliances:	751	751
Photovoltaics:	-0	-0
Service Charge:	120	120
Total:	**1788**	**1641** *

Window U-Factor Check (Section 402.5)		
Window U-Factor (Design must be equal or lower):	0.480	0.330
Home Infiltration (Section 402.4.2):		PASSES
Duct Leakage (Section 403.2.2):		PASSES

This home MEETS the annual energy cost requirements and verifications of Section 405 of the 2009 International Energy Conservation Code based on a climate zone of 4A. In fact, this home surpasses the requirements by 16.0%.

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Topic 2 Objectives

- Review examples of tools to enhance compliance with the code prior to submittal
- Review the plans review process
- Review the inspections required

Plans Review

Phoenix, AZ has an 10 page review and on the last page is a requirement for the home to meet the energy code – it could be more helpful

ENERGY CODE COMPLIANCE:

1) IRC Chapter 11 or
2) IECC (Prescriptive or Performance).
   a) Prescriptive IECC 401, 402, and 403
   b) Performance based IECC 404

Plans Review

Checklist:

- Defined pathway of compliance
- Mandatory notes included on the plans
- Compliance is accurate/no inconsistencies
- Standard fiberglass batts used in 2x6 to meet wall requirements

Topic 2 Objectives

- Review examples of tools to enhance compliance with the code prior to submittal
- Review the plans review process
- Review the inspections required

Inspections

Inspection checklists

- RES*check* inspection checklist
- REM/Design inspection checklist
- Georgia Residential Energy Code Inspection checklist
- Department of Energy 2009 IECC checklist:

  http://www.energycodes.gov/arra/compliance_evaluation.stm

Inspections

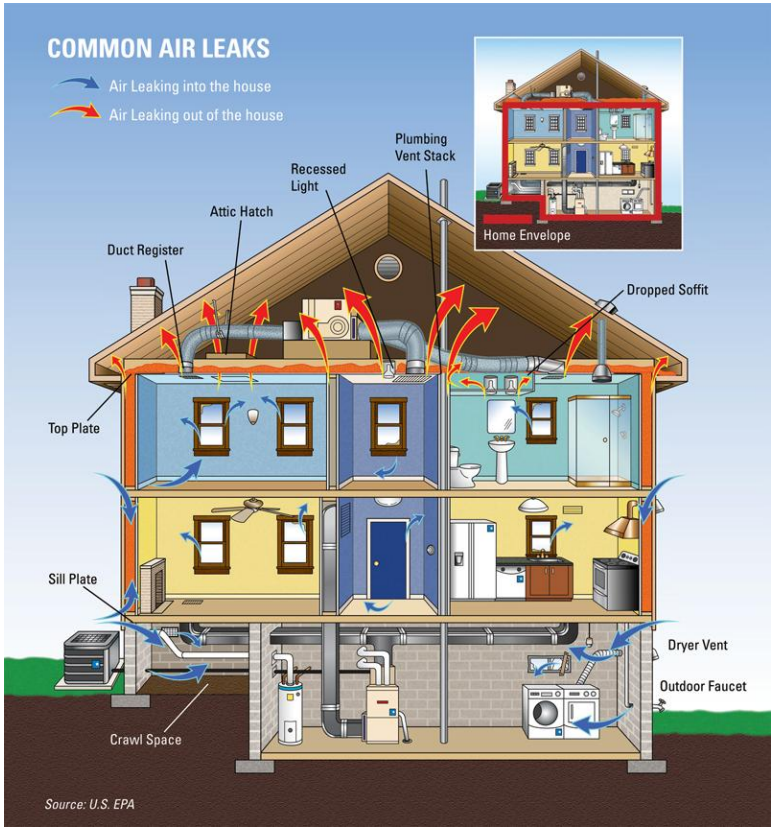
- Insulation

- Final

Inspections

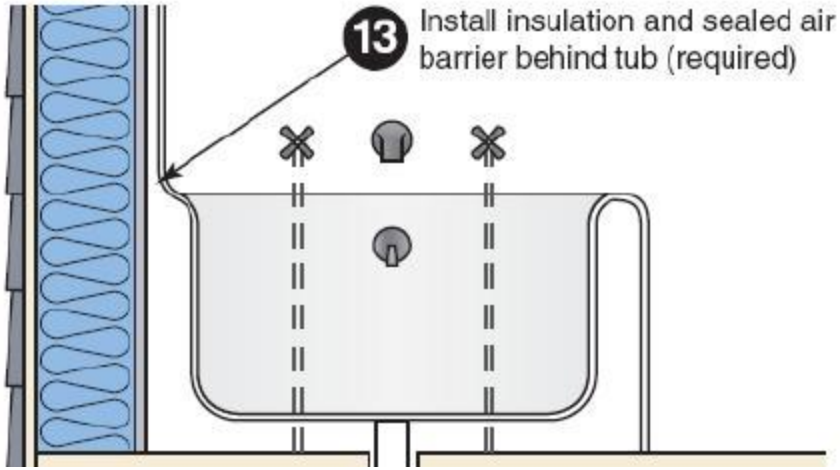
Thermal Bypass -

"Exterior thermal envelope insulation for framed walls is not installed in substantial contact and continuous alignment with building envelope air barrier."



Inspections

Common air barrier/insulation mistakes



http://www.dca.state.ga.us/development/constructioncodes/programs/documents/IECC2011Amendments-effective_001.pdf

Inspections

No rigid air barrier is installed behind fireplace.

http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_v2_v3_training_resources

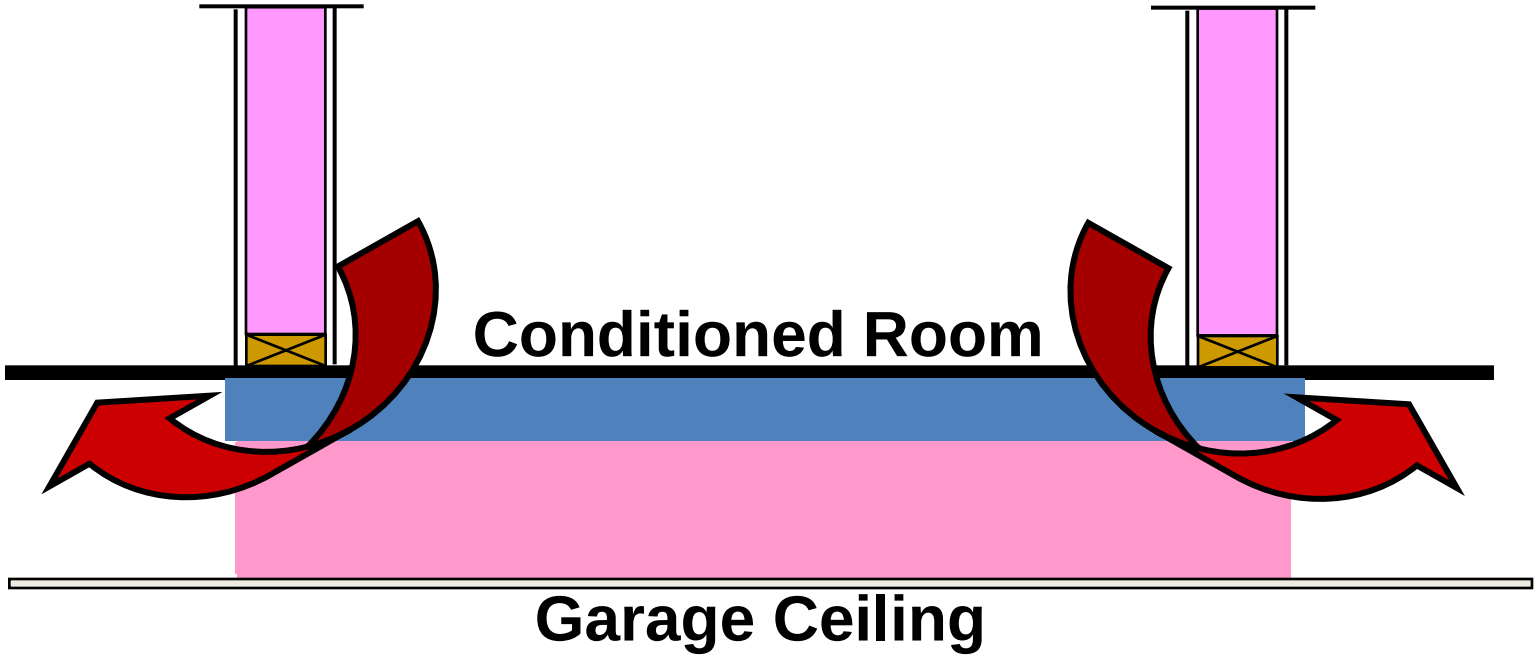
Inspections

Insulation is misaligned with floor above.

http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_v2_v3_training_resources

Inspections

Insulation is misaligned with floor above.



http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_v2_v3_training_resources

Inspections

Insulation has misalignment, compression, and gaps.

http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_v2_v3_training_resources

Inspections

Compression and misalignment because insulation is not split around wires.

http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_v2_v3_training_resources

Inspections

Improperly installed insulation and no rigid backing.

http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_v2_v3_training_resources

Inspections

Hole has not been air sealed.

http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_v2_v3_training_resources

Inspections

R401.3 Certificate (Mandatory). A permanent certificate shall be posted on or in the electrical distribution panel… shall be completed by the builder or registered design professional…shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, *basement wall*, crawlspace wall and/or floor) and ducts outside conditioned spaces; U-factors for fenestration and the solar heat gain coefficient (SHGC) of fenestration, and the results from any required duct system and building envelope air leakage testing…shall list the types and efficiencies of heating, cooling and service water heating equipment.

Inspections

APPENDIX D
SAMPLE COMPLIANCE CERTIFICATE

Georgia Residential Energy Code Compliance Certificate*

Builder/Design Professional: _____ Phone: _____

Envelope Summary:

- List the R-Value for the following components:

Flat ceiling/roof:		Sloped/vault ceiling:	
Exterior wall:		Above grade mass wall:	
Attic kneewall:		Attic kneewall sheathing:	
Basement stud wall:		Basement continuous:	
Crawlspace stud wall:		Crawlspace continuous:	
Foundation slab:		Floors over unconditioned space:	
Cantilevered Floor:		Other insulation:	

- Fenestration Components:

Window U-factor:		Window SHGC:	
Skylight U-factor:		Skylight SHGC:	
Glazed Door U-factor:		Opaque Door U-factor: (<50% glazed)	

- Building Envelope Tightness (BET):

BET test conducted by: _____ Phone: _____

Fan Flow at 50 Pascals= _____ CFM_{50} Total Conditioned Volume = _____ ft^3

ACH_{50} = CFM_{50} x 60 / Volume= _____ ACH_{50} (must be less than 7 ACH_{50})

Low Rise Multifamily Visual Inspection Option

(The visual inspection option may be conducted by a third-party instead of the BET test for R-2 buildings only.)

Visual inspection conducted by: _____ Phone: _____

Mechanical Summary:

Water Heater Energy Factor: _____ EF Fuel type: ☐ Gas ☐ Electric ☐ Other

Number of Heating and Cooling Systems: _____

Heating System Type (choose one):

☐ Gas: _____ AFUE ☐ Air-Source Heat Pump: _____ HSPF

☐ Other: _____ Efficiency: _____

Cooling System Type (Standard DX, Heat Pump, Geothermal, etc.): _____

Cooling System Efficiency: _____ ☐ SEER ☐ EER ☐ Other

Heating/Cooling Load Calculations Performed by: _____ Phone: _____

Total Heating Load (Based on ACCA Man. J or other approved methodology): _____ Btu/h

Total Cooling Load (Based on ACCA Man. J or other approved methodology): _____ Btu/h

Cooling Sensible Load: _____ Btu/h Cooling Latent Load : _____ Btu/h

Total Air Handler CFM (based on design calculations): _____ CFM

Duct Tightness Test Conducted by: _____ Phone: _____

CFM_{25} per 100 ft^2 of conditioned floor area = CFM_{25} x 100 / Conditioned floor area served

If all ducts are not located within conditioned space, builder must verify that either the postconstruction duct leakage to outdoors (**PCO**) is ≤ 8 cfm/100 ft², the post construction total duct leakage (**PCT**) is ≤ 12 cfm/100 ft², or the rough-in test (**RIT**) with air handler installed is ≤ 6 cfm/100 ft². State which method was used to conduct the duct tightness test: duct blower (**DB**), modified blower door subtraction method (**MBDS**), or automated multipoint blower door (**AMBD**).

System	Method (DB, MBDS, AMBD)	Test (PCO, PCT, RIT)	CFM_{25}	Area served (ft^2)	Test Result
1					
2					
3					

*Note: This permanent certificate shall be posted on or in the electrical distribution panel. Certificate shall be completed by the builder or registered design professional. Where there is more than one value for each component, certificate shall list the value covering the largest area.

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Topic 2 Summary

- Tools prior to submittal
  - Determination worksheet
  - Compliance forms
  - Permit submittal checklists
  - Certificates
- Tools for plan review and inspection
  - Plans review checklist
  - Inspection checklist

Next Steps

Adoption of the IECC

- How are current practices different?
- Obstacles to implementing the code?
- Solutions?

Thank You – comment card

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